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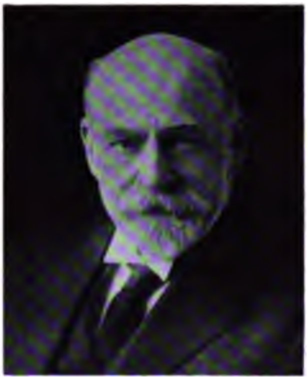

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GEOLOGICAL SURVEY

OF

ALABAMA.

EUGENE ALLEN SMITH, Ph. D., State Geologist.

REPORT

ON THE

COAL MEASURES

OF THE

PLATEAU REGION OF ALABAMA,

BY

HENRY McCALLEY,

ASSISTANT STATE GEOLOGIST,

INCLUDING

A REPORT

ON THE

COAL MEASURES OF BLOUNT COUNTY.

BY

A. M. GIBSON.

With a Map of the Coal Fields and two Geological Sections across the Plateau Region and Intermediate Valleys.

MONTGOMERY, ALA.:
SMITH, ALLRED & CO., STATE PRINTERS AND BINDERS,
1891.

208372

To His Excellency,

THOS. G. JONES,

Governor of Alabama:

SIR—I transmit herewith a report on the Coal Measures of the Plateau Region of Alabama by Henry McCalley, and A. M. Gibson. This report has been in great part on hand for the past three or four years, but it has been recently entirely revised by Mr. McCalley and brought up to date, and the results of some careful testing by the L. & N. R. R. authorities in parts of the field, added.

The report of Mr. C. W. Hayes, upon the Valley Regions of this part of the State, is not yet quite ready for publication, and it will, therefore, appear in a future report.

I have the honor to be, sir,

Your obedient servant,

EUGENE A. SMITH,

State Geologist.

University of Alabama,

July 1st, 1891.

PREFACE.

In the following pages, mention is frequently made of the geological formations underlying the Coal Measures and appearing in the Valleys that separate the Coal Plateaus.

For the better understanding of the relative position of these formations, their prevailing constituents, and the names used to designate them,—the following short account has been prepared—in which they are taken up in descending order.

COAL MEASURES.

As Mr. McCalley states, it is, as a rule, only the lower strata of the Coal Measures that appear in the Plateau Region. These consist of two Conglomerates underlying a variable thickness of other strata, and separated by about 150 feet of sandy shales; and, below the Conglomerates, of 300 or 400 feet of shales and sandstones. The number and characters of the coal seams appearing in these lower measures are sufficiently well shown in the report.

SUB-CARBONIFEROUS.

The Sub Carboniferous strata consist of a limestone, shales and sandstone, forming what we have called the upper division, and a series of cherty or siliceous limestones forming the lower division. The whole thickness of the formation will average not less than 1200 feet.

Upper Division.—The limestone which is commonly found immediately below the Coal Measures is known as the Mountain Limestone or Bangor Limestone, probably equiv-

alent to the Chester group of the Western Geologists; the shales and sandstones below this limestone have been called the Oxmoor beds from the region of their most characteristic occurrence, but in the following pages an older name is most frequently used by Mr. McCalley, viz., LaGrange Sandstone. This sandstone always makes a marked topographic feature in the valleys separating the different parts of the plateau region. The limestone and sandstones and shales together will average perhaps 1000 feet in thickness.

Lower Division.—As already said, this division consists in the main of cherty or siliceous limestones, especially in the northern part of the area here described, i. e., in the Tennessee Valley, where two well marked distinctions can always be made. These are the strata that make the "Barrens" and the "Red Lands," respectively, of the Valley. In the anticlinal valleys which separate the plateaus it is impossible to make this distinction, for the whole of this lower division shows upon the surface at least, very little else than angular fragments of chert (or "flint") which are usually full of impressions and moulds of fossils, and hence spoken of commonly by Mr. McCalley as fossiliferous chert. A better name would be "Fort Payne chert," a name adopted by the Survey in the Cahaba Report lately published. The thickness of the cherty limestones may average perhaps 400 feet. They are, in the main, the equivalents of the St. Louis, Keokuk, and Burlington beds of the Western Geologists.

DEVONIAN.

The only representative in Alabama of the Devonian formation is found in a thin stratum of Black Shale, averaging perhaps, in the region of this report, not more than ten or fifteen feet in thickness. It is usually designated as the Black Shale in our reports.

SILURIAN.

The *Clinton* or *Red Mountain* formation is the uppermost of the Silurian divisions defined in our State. It consists of sandstones, shales, and red iron ore, aggregating some 100 feet in thickness.

The *Trenton* or *Pelham* limestone, 800 feet in average thickness, includes a variety of calcareous strata, tolerably pure above and shaly in the lower part.

Knox Dolomite.—This is one of the most important of the formations occurring in the Valleys, since its strata occupy a large proportion of the area of these valleys. The materials of the Knox Dolomite are mostly siliceous or cherty limestones and dolomites, and by the leaching out of the calcareous parts, the cherty or siliceous portions are usually left as a surface mantle of angular flinty gravel. This formation is otherwise important as bearing the greater part of the brown iron ore of the State. It is difficult to arrive at a very reliable estimate of the thickness of this division, but it cannot be less than 5,000 feet.

CAMBRIAN.

The divisions of the Cambrian in Alabama in descending order, are the *Choccolocco* or *Montevallo Shales* and the *Coosa Shales*, and, interbedded with the former, in the eastern part of the Coosa Valley, great masses of coarse grained sandstone, forming what we have termed the *Weisner Quartzite*. In the Valleys treated of in this report, we can usually distinguish only the lower or Coosa Shale division. The rocks of this division (Coosa Shale) are thin-bedded limestones with clay seams between, and in disintegrating they give rise to heavy clay soils, which, on account of the generally very level nature of the country made by them, justify the popular name of "Flatwoods" by which they are everywhere known and designated.

Inasmuch as the sandstones and sandy shales of the Cambrian are found only along the eastern border of the area of occurrence of Cambrian strata in this State, it seems quite probable that in the western part of this area, calcareous strata were accumulating during the whole of the period of the Cambrian, and that the "Flatwoods" limestones with their interbedded clay seams are the time equivalents, not only of the Coosa Shales, but also of the Choccolocco or Montevallo Shales and their included sandstones.

We have not yet the data necessary for determining the thickness of the Cambrian strata in Alabama; but in the eastern part of the Coosa Valley—where the great mountain-making sandstones or quartzites are included in the shales, the thickness can hardly be less than 10,000 feet. In the Valleys mentioned in this Report the Cambrian rocks are much thinner.

It will be seen in the Reports of Messrs. McCalley and Gibson that certain parts of this Plateau Region are likely to prove to be important Coal areas, especially the Blount Mountain and Berry Mountain regions.

Further investigations are now being carried on there for the Geological Survey—by Mr. Gibson.

EUGENE A. SMITH.

ON THE

COAL MEASURES

OF THE

PLATEAU REGION OF ALABAMA.

TABLE OF CONTENTS.

LETTER OF TRANSMITTAL.

DR. E. A. SMITH,
State Geologist:

SIR:—The following is a report of the Coal Measures of the Plateau Region of Alabama.

It treats of all of the Coal Measures of the Plateau Region of the State with the exception of those that were included in the Report on the Warrior Coal Field, published in 1886. It also speaks of the Coal Measures of St. Clair and Shelby counties because the measures of those counties are principally of plateau strata and have never been considered as a whole, in the case of either of the counties, in any previous report. It is of notes that have been taken on different trips during the last twelve years, and while it does not pretend to be a final report or to represent a complete examination of the measures of which it treats, yet it is believed to give a good general idea of them and especially of their coal seams.

The Introduction is a general description of the Plateau Region as a whole, and the body of the report is a detailed description of the Coal Measures of the counties of Madison, Jackson, Marshall, Morgan, Lawrence, Franklin, DeKalb, Cherokee, Etowah, Blount, St. Clair and Shelby.

The report also includes some additional notes by Gen. A. M. Gibson to his report of 1886 on the Coal Measures of Blount Mountain, and ashort report by him on the Coal Measures of Berry Mountain, a part of the Raccoon Mountain.

It also includes a great number of *bed sections* of coal outcroppings on Raccoon and Blount Mountains, that were kindly furnished, without cost to the Survey, by the L. & N. R. R., for which I here extend my thanks.

It also includes a map showing the location of the Coal Measures of the State, and two sections showing the structures of the mountains of the Plateau Region and of the intermediate valleys.

Very respectfully,

HENRY MCCALLEY.

University of Alabama,
June 1, 1891.

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I. INTRODUCTION.

THE COAL MEASURES OF THE PLATEAU REGION OF ALABAMA.

The Plateau Region of Alabama consists of the high, wide flat and plainlike areas of the tops of the Cumberland Mountains, Sand Mountain, Raccoon Mountain and Lookout Mountain. These names are more or less indefinite in their applications, but as used in the following pages the *Cumberland Mountains* include all the mountain spurs, etc., to the north of the Tennessee River; *Sand Mountain* the high escarpment and plateau to the south of that river and Moulton Valley, and to the north-west of the Brown's or Blountsville Valley; *Raccoon Mountain* the high broad plateau to the south-east of the Brown's or Blountsville Valley and to the north-west of Big Wills' Valley; and *Lookout Mountain*, the extension into Alabama of the Lookout Mountain of Tennessee and Georgia, is between Little Wills' Valley on the north west and the Coosa Valley on the south-east. (See map and sections.)

This Plateau Region is made up entirely of Coal Measures, though the mountains of which it forms the tops are separated from each other by, and have running up into them, deep valleys denuded down into Sub-carboniferous and much lower rocks, geologically speaking. These valleys, with the exception of the Tennessee Valley below Guntersville, are anticlinal valleys and have a general north-east and south-west trend.

The plateaus or Coal Measures of these mountains are sharply defined by high abrupt bluffs which cap the Sub-car-

boniferous rocks of the steep mountain sides. These steep mountain sides have usually one or more benches on them. The Plateau Region of Alabama as above marked out comprises some 4,500 square miles. It is from 1,000 to 2,000 feet above tide water level, and from 300 to 1200 feet above the level of the adjacent valleys. It is most elevated in the north-east corner of the State and gradually slopes from this point to the south-west. The portions of the different mountains are highest along their edges or rims, next to the anticlinal valleys, and gradually slope and dip in undulations away from these elevated rims. These portions are therefore all broad shallow synclinal troughs or parts of such troughs. Their strata, and so their surfaces in many places, are in long flat waves from north-east to south-west and also from north-west to south-east. The waves from north-east to south-west are usually much larger than the others. The Plateau Region is a country of beautiful, wild and interesting scenery. It is, away from the edges of the mountains and the water courses, generally an open woods country, with but little undergrowth and with a luxuriant growth of grasses and ferns, and is just enough rolling and indented with hollows and ravines to make the landscape pleasing to the eye, but on the edges of the mountains and on the water courses it is quite different, and the scenery is often grand, wild, and picturesque. The elevated high bluffs, etc., of its borders or of the tops of its steep mountain sides, and the high water falls, etc., of its creeks and branches often produce sights that are well worth the travel of many miles to see.

This Plateau Region has a mild and salubrious climate, and an atmosphere that is so pure, dry and light, as to be a perfect safe-guard against the chills and fevers of the valleys. The mean winter temperature for December, January, and February is about 44° F; the mean summer temperature for June, July and August is about 76° F; and the mean annual temperature is about 55° F. The annual summer temperature is several degrees less than that of the valleys. The drainage is perfect and so it is infected with no marshes or mala-

rial causes. The mean winter rainfall is about 14 inches, the mean summer rainfall about 13 inches, and the mean annual rainfall about 55 inches.

Under the high bluffs capping the mountain sides are numerous fine free flowing springs of freestone, chalybeate and alum waters. These springs, from 200 to 1000 feet above the valleys, furnish the coldest natural waters of the State. They, according to Prof. Tuomy, have an annual temperature of about 55° F., while those of the valleys have an annual temperature of about 60° F.

The soil is naturally poor and thin; it is principally a light, more or less yellowish, sandy loam, that is deficient in organic matter, lime, and phosphorus, though it has a fair amount of potash. It however grows well, without help, the choicest of root and fruit crops and grasses, and with frequent light applications of a suitable compost, as a superphosphate of lime and green crops, can be made to yield a good diversity of crops that are equal in every respect to those raised in sections that are much more highly favored in natural fertility of soil. Thus treated it will bring good cotton, corn, oats, rye, rice, sorghum, Irish and sweet potatoes, turnips, ground peas, etc., etc. It can easily be made to yield to the acre 250 lbs., of lint cotton, of much better staple than that of the valleys, or 25 bushels of corn. The soil is most easily cultivated; and though they may be poor, there is no class of people that live better with less work than do the farmers of this region. The natural pasturage is fine and supports the cattle of the valley as well as those of the mountains for some eight months in the year.

This region is still for the most part covered with its virgin forests of post oaks, Spanish oaks, scarlet oaks, tan bark oaks, black oaks, chestnuts, hickories, gums, short and long leaf pines, dogwood, sour-wood and sassafras. The steep mountain sides and the coves have, in many localities, been covered with a fine growth of the best of hard woods, as red cedars, black walnuts, chestnut oaks, yellow poplar, white ash, white oaks, red or sweet gum, linden trees, elms, hickories, beech, etc. These lands are now however being rapidly

cleared up and as the virgin soils are becoming better understood, are growing into great favor as most desirable horticultural and farming lands. This region is also as yet thinly settled, on account of the supposed sterility of its soil, but as its great natural advantages are recognized, it will doubtless become more and more popular and will probably eventually, on account of its delightful and invigorating climate and healthfulness and fine water, be dotted over with public and private summer retreats from the turmoil, heat, mud, dust and smoke of the booming towns and cities. Over the bluffs above the springs there are often beautiful sites for these summer retreats, and from these sites the views are magnificent and extend for miles, uninterrupted, up and down the valleys.

The Coal Measures of this Plateau Region are made up for the most part of the hard conglomerates near the base of the measures and of the measures under and between these conglomerates. These measures can perhaps be best described by giving a section of them where they are well developed and then referring the different out crops, etc., to their respective places in this section. They are well developed at the Etna Mines, Tennesse, near the Alabama line, and hence the following section is given:

ETNA SECTION.

Sandstone, 73 ft.
Shaly Sandstone, 32 ft.
(10) COAL, 4 ft.
Slate, with a thin *COAL*, 46 ft.
(9) COAL; with Slate parting, 6 ft.
Shale, 44 ft.
(8) COAL, (*Kelly Seam*); 2 to 5 ft.
Fire Clay, 1½ ft.
(7½) SANDSTONE (*Upper Conglomerate*). 82 ft.
(7) COAL, ¼ ft.
Yellow Sandy Shale, 45.
COAL; thin.
Gray Shale. 47 ft.
(6) COAL, (*Sewanee Seam*); 1 to 2 ft.
Gray Sandy Shales, 45 ft.

ETNA SECTION—continued.

(5½) CONGLOMERATE (LOWER); *Cliff Rock, Millstone Grit*, 96 ft.
(5) COAL, (*Main Etna Seam*); 2 to 5 ft.
Fire Clay, 2 ft.
Shale, 20 ft.
(4) COAL, (*Dade or Eureka Seam*); 1 ft.
Gray Shale, 95 ft.
[3) COAL, ½ ft.
Black Shale with iron, 20 ft.
(2) COAL, 3 ft.
Shale with iron balls, 40 ft.
Gray Shale, 34 ft.
(1) COAL, 2 ft.
Fire Clay, 2 ft.
Shales and Sandstones, 100 ft.

MOUNTAIN LIMESTONE.

The above section is taken from the Report of Prof. Henry E. Colton, Geologist and Inspector of Mines, Tennessee, 1883.

The high bluffs spoken of as capping the steep mountain sides and as sharply defining the Plateau Region, when there are two of these bluffs one above the other as is usually the case, are formed of the conglomerates (5½) and (7½) of the above section, and when there is only one row of bluffs of the *Conglomerate* (5½) alone. The *Conglomerate* (5½), the *Lower Conglomerate* of Safford, is commonly known as the *Millstone Grit* and as the *Cliff Rock*. The *Conglomerate* (7½), a sandstone in the above section, is the *Upper Conglomerate* of Safford. The Upper Conglomerate is the surface rock over most of the Plateau Region. It often times crops out back from the brinks of the mountains, and along the creeks and branches, and occasionally in naked glady places over the tops of mountains.

These conglomerates give to the Plateau Region not only its distinct outlines, but also its prominence and perhaps even its existence since; but for the hard weather resisting qualities of these rocks the Plateau Region would probably have long since been, for the most part, washed away. These conglomerates vary very much in thickness and com-

position. They usually carry small rounded flint pebbles, but occasionally they are nothing more than coarse quartzose sandstones, that on weathering become sometimes merely heaps of loose sand that glistens in the sun-light. The small rounded flint pebbles in them occur sometimes intimately mixed throughout the masses of the rocks, sometimes in only the upper parts of the rocks, and most often in irregular patches or seams near the bottoms of the rocks. These two conglomerates are usually separated from each other by from 25 to 30 feet of other strata, but occasionally they come together and at other times are as much as 150 feet apart. The lower of these two conglomerates is, as a general thing, much the thicker and harder of the two. In many places it is well suited for millstones and in a few localities has been so used, hence its name *Millstone Grit.* These conglomerate bluffs are frequently seen from the valleys below to be in great waves from north-east to south-west.

In these conglomerates, and between and under them, there are frequently seams of flagstones of great regularity in thickness with either perfectly smooth or beautifully rippled marked sides. These flagstones are well suited for curbing and paving purposes and some of them are of good coarse sharp grit for whetstones and grindstones.

The Coal Measures below or under the *Lower Conglomerate* (5½) or the *Millstone Grit* have been called the *Lower Measures*, and those above or over the *Upper Conglomerate* (7½), the *Upper Measures.* The Lower Measures of the Plateau Region of Alabama are usually from 40 to 50 feet in thickness though they sometimes swell up to a thickness of 700 feet or more. They have also been called the *false measures;* improperly so, however, for the reason that they bear in places from one to five coal seams, and have furnished, mainly from one seam, about all of the coal that has ever been taken from the Plateau Region of Alabama and from many localities in Tennessee. The *Lower Measures* however in a general way do become more and more barren towards the south-west, or their coals thin out in this general direction. The most reliable or most persistent and, as a

general thing, thickest coal seam of the *Plateau Region* is of the seam that has furnished about all of the coal that has ever been taken from the Plateau Region of Alabama and from many localities in Tennessee. It is (5) of the Etna Section and is known as the *Cliff Seam.* It occurs just under the *Lower Conglomerate* or *Millstone Grit* and shows, to a greater or less extent, in a very great number of places under the bluffs of this rock. The coal of this seam, as well as those of the other seams of the Plateau Region in Alabama, is of very variable thickness. It has been seen to bulge out to a thickness of 5 to 6 feet, and within a few feet of these thick pockets to be squeezed out to only a few inches in thickness. Similarly with the *Dade Seam*, (4) of the Etna Section, varies within a few teet from a thickness of about 14 feet down to about one foot. The thick *pockets* and *squeeze-outs* in these coals are most often due to sudden swells or sinks in the floors, or underbeds, though they are sometimes caused by the interpolation, thickening and thinning of shales in the roofs or covers. These coals are usually of good quality, but the quality varies with the locality. They are commonly very hard and solid and not very bituminous. Some of them are lamellar in structure, others are cubical. They frequently carry much sulphur or pyrites. They have never been worked to any very great extent in Alabama and only for home consumption, principally by the neighborhood blacksmiths, except in Jackson and DeKalb counties.

In the Coal Measures of the Plateau Region at and near some of the coal horizons, principally underbeds to the coals, there are seams of a light gray clay which on the out-crops are from one to six feet in thickness. These clays are often very fossilleferous with stem and leaf impressions; when dry they are very hard, but when thoroughly wet they are very plastic and are well suited for common pottery purposes as has been shown by actual use in many localities.

In these measures, there is also in certain localities much *clay ironstone* in regular stratified seams and interstratified layers of nodules. These measures also carry in places considerable *black-band ore.* These ores usually occur in the

Lower Measures, below the *Millstone Grit*, though oc sionally they are seen in the *Upper Measures*. Near base of these measures, there crops out in many places the sides of the mountains a regular stratified seam of i ore that sometimes reaches a thickness of four feet. T ore in the out-crops is a regular *limonite* though doubtless changes within to a carbonate. On the sides of the mo tains, below the out-crops of this ore and sometimes remo from them for one-fourth mile or more and mixed w debris from the conglomerates above the ore out-croppi are numerous deposits of limonite which have doubt come from the out-croppings of the above seam of Some of these deposits of limonite are of considerable exte Most of it is of good quality, though some of it is san In most of the deposits it is mixed with loose rocks, e and so it would be expensive to mine.

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Lower Measures, below the *Millstone Grit*, though occasionally they are seen in the *Upper Measures*. Near the base of these measures, there crops out in many places on the sides of the mountains a regular stratified seam of iron ore that sometimes reaches a thickness of four feet. This ore in the out-crops is a regular *limonite* though doubtless it changes within to a carbonate. On the sides of the mountains, below the out-crops of this ore and sometimes removed from them for one-fourth mile or more and mixed with debris from the conglomerates above the ore out-croppings are numerous deposits of limonite which have doubtless come from the out-croppings of the above seam of ore. Some of these deposits of limonite are of considerable extent. Most of it is of good quality, though some of it is sandy In most of the deposits it is mixed with loose rocks, etc. and so it would be expensive to mine.

II. COUNTY DETAILS.

I. THE COAL MEASURES OF MADISON COUNTY.

The Coal Measures of Madison county are confined to the tops of the higher mountains in the eastern halt of the county to the east of the Hnutsville Meridian. These high mountains are nothing more than spurs and detached peaks of the western edge of the great table land of Tennessee or of the Cumberland Mountains. The detached peaks are connected together sometimes into mountain chains, sometimes into mountain groups aud sometimes are isolated. The most prominent of these peaks have received distinct names. The spurs extend down from Tennessee. They occur along aud near the Jackson county line in the north-east quarter of the county. The detached peaks in the mountain chains, etc., are to be found in the south-east quarter of the county. They extend as far west as the Huntsville mountain, Monte Sano. There are *little mountains* to the west of the Huntsville or Monte Sano mountain, but they do not have in or on them any Coal Measures. The Coal Measures of the Huntsville or Monte Sano chain of mountains are therefore the most western in Alabama north of the Tennessee River. The mountain chains and groups have spurs extending out from them with coves running up between these spurs and between the peaks. The mountains of this county are all due entirely to erosion and hence are mountains merely because the intervening parts have been washed away. The peculiar or remarkable features of these mountains are that they are flat, or have plateaus or level areas of table land on top that are bounded along the edges of the mountains by cliffs from 20 to 150 feet in perpendicular height. These level areas or Coal Meas-

ures are also scalloped and notched along the edges, and are sometimes cut entirely in two by deep coves extending up into them. They cover some 800 square miles in this county and are from 1000 to 1600 feet above the sea and from 400 to 1000 feet above the adjoining valleys.

The general description given in Introduction of the Coal Measures of the Plateau Region of Alabama will also answer for the Coal Measures of this county.

DETAILS.

The *Cliff Seam*, (5) of the Etna section, varies in this county from 0 to 2 feet in thickness and is the only seam of coal that is positively known to occur in the county. More or less traces of it can nearly always be found under the capping bluffs. The Huntsville or Monte Sano chain of mountains consists of high peaks, capped with Coal Measures, with gaps between these peaks. Over some of the gaps the Coal Measures have been entirely removed and the Mountain Lime stones are the surface rocks. Some of the high peaks have distinct names, as, Monte Sano, Round Top Mountain, Flat Mountain, etc. Monte Sano is the most northern and western peak of the Huntsville Mountain that is covered with Coal Measures; in fact, its Coal Measures are the most western in Alabama north of the Tennessee River. The mountain knobs, spurs and peaks farther to the north and west are made up of Mountain Limestone, with usually a capping of *La Grange Sandstone* and a base of *St Louis Limestone*. The following is an approximate section of the strata of Monte Sano:

MONTE SANO SECTION.

(10) SANDSTONE (*Cliff Rock*); massive and ferruginous, 30 to 75 ft.
(9) *Shales, Sandstones*; The Shales are gray and the sandstones are shaly.
(8) COAL, (Cliff Seam, (5) of Etna Section); 0 to 1 ft. 6 in.
(7) *Shales*; argillaceous and fossiliferous, 2 to 10 ft.
(6) *Mountain Limestone*; fossiliferous, 300 to 400 ft.
(5) SANDSTONE (*LaGrange*); ferruginous and fossiliferous, 10 to 15 ft.
(4) *Limestone* (*Mt. Limestone*); blue, 0 to 10 ft.
(3) SANDSTONE (*LaGrange*); coarse grained, 0 to 10 ft.
(2) *Limestone* (*Mt. Limestone*); gray, 450 to 500 ft.
(1) *St Louis Limestone*, 75 to 125 ft.

On the west side of Monte Sano, there are some half-dozen old drifts in the outcroppings of the *Cliff Seam* of coal. At the mouths of two of these drifts, there occur the following sections:

SECTION AT DRIFT NO. 1, MONTE SANO.

(5) SANDSTONE (*Cliff Rock*); massive at botton, flaggy above. 30 ft.
(4) COAL, 0 to 0 ft. 5 in.
(3) *Sandstone*; shaly, 8 in.
(2) COAL; mining in blocks, full of pyrites, 1 ft. to 1 ft. 2 in.
(1) *Shale*; clayey, fossiliferous, visible, 2 ft. 10 in.

SECTION AT DRIFT NO. 2, MONTE SANO.

(6) SANDSTONE (*Cliff Rock*); ferruginous, slabby at top, then massive and then shaly, 30 ft.
(5) COAL, 0 ft. 2 in.
(4) *Sandstone* COAL; Sandstone, spongy and micaceous, with thin streaks of *Coal*, 3 in.
(3) *Shale*, COAL; shale, slaty, with thin streaks of *Coal*, 2 in.
(2) COAL; with much pyrites, 1 ft. to 1 ft. 2 in.
(1) *Shale*; very clayey, fossiliferous.

As will be observed from an inspection of the above sections, on Monte Sano the *Cliff Rock* is merely a sandstone. The coal of this peak appears to dip to the S W S., about 25 feet to the mile. Though it mines in large lumps and is hard, it soon crumbles on weathering from the large amount of pyrites that is in it.

One of the spurs of the Huntsville Mountain in S. 36, T. 3, R. 1 E , has about the following section:

SECTION OF MOUNTAIN SPUR IN S. 36, M. 3, R. 1 E.

(6) *Debris*; gradual slant to top, 15 ft.
(5) SANDSTONE (*Cliff Rock*), 20 ft.
(4) *Debris*; covering a bench, may cover some *Coal*, 20 ft.
(3) *Mountain Limestone*; Debris with one bench, 175 ft.
(2) *Sandstone* (*LaGrange*), 25 ft.
(1) *Mountain Limestone.*

In the upper part of (4), there is a deep shaft that has been sunk in search of silver. It was located by the *mineral rod*. The only metal discovered was pyrites.

The next high peak to the south of Monte Sano is known as the *Round Top Mountain*. Its Coal Measures are not connected with those of Monte Sano but are worn away over the gap between, along the Huntsville and Vienna pike. The coal of this peak, the *Cliff Seam*, is said to be of about the same thickness as in Monte Sano. The mountain in S. 10, T. 5, R. 1 E., has several benches along its side and is capped with a bluff (*Cliff Rock*) some 50 ft. high. Under this bluff, the *Cliff Seam* shows as several thin seams of coal of a few inches each in thickness.

The out croppings of *LaGrange Sandstone* on the sides of these mountains can be easily recognized from the valleys by the growth of pine over it with cedars growing up on the limestones above and below.

The mountain chain bordering on the Tennessee River between Flint and Paint Rock rivers is known as the *McKennie Mountain*. In it the *Cliff Seam* of coal is close on to 150 feet below the top of the mountain and is about 10 inches thick. This mountain down in the angle formed by the Tennessee and Paint Rock rivers juts up close to both of these rivers in the high bluff known as the *Flat Rock Bluff*. The top of this bluff is some 500 feet above the level of the rivers at its base. About 200 feet of this height is a perpendicular wall of the upper Mountain Limestones, above the LaGrange Sandstone. The LaGrange Sandstone is hid by the

debris at the foot of the bluff, and the Coal Measuers set in just above the bluff in a slant, and run up to a thickness of from 100 to 300 feet. The out-croppings of the coal of this mountain, the *Cliff Seam*, is said to be about 14 inches thick. This coal shows in several out croppings in the western part of S. 8, T. 6, 2 E. This mountain also has deep coves running up between its high peaks.

The mountain groups north of Vienna and south of the M. & C. R. R., and between Flint and Paint Rock rivers, form the *Keel Mountains*. These mountains are so cut up by deep coves and valleys as to have a very dissected appearance. Their higer peaks all contain more are less traces of the *Cliff Seam* of coal under the capping bluffs. The high mountain peak principally in S's 7 & 8, T. 5, R. 2 E., has on its sides several benches and on top the usual flat plateau. Some 40 feet under this plateau, under the capping bluff, the *Cliff Seam* of coal frequently shows itself, with sometimes a thickness of 18 inches. There is also found on this mountain a thin flagstone that makes a fine whetstone. The high peaks of the Keel Mountains in the northern and eastern parts of R. 2 E., and the western part of R. 3 E., both of T. 5, show in many places under the bluffs which cap them, out-crops of the *Cliff Seam* of coal, from 8 to 12 inches in thickness. In some of these peaks, at least, there is, some ten feet above the main coal horizon, with shales and sandstones between, another seam of coal about six inches thick, and some five feet higher, with shales and sandstones between, is still another seam of coal from three to twelve inches in thickness. This upper coal has partings of sandstone. From some of these coal out-crops issue bold springs of strong chalybeate waters.

The high mountains to the north of the M. & C. R. R. are connected with the great table land of Tennessee and hence are connected spurs of the Cumberland Mountains. These high mountain spurs are separated by deep coves and it is almost impossible to climb them from the coves, except by following up the water courses. They all have flat plateaus on top, and perpendicular bluffs around the crest of their edges.

The most southern point of these spurs in this county, in the N. E. corner of S. 1, T. 4, R. 2 E., has about the following section :

SECTION OF MOUNTAIN SPUR IN N. E. ¼ of S, 1. T. 4, R. 2 E

(8) SANDSTONE (*Cliff Rock*), 50 ft.
(7) COAL, 6 in., to 1 ft.
(6) *Debris*; sandstones and shales, 150 ft.
(5) *Debris*; calcareous rocks, 35 ft.
(4) *Mountain Limestone*, 75 ft.
(3) SANDSTONE (*LaGrange*); ferruginous, 15 ft.
(2) *Mountain Limestone*; massive, slabby, shaly, granular and argillaceous, 175 ft.
(1) *St. Louis Limestone*, 150 ft.

There are no pines on the sandy plateau of the above spur, the growth, strange to say, consisting of poplar, chestnut and oaks. Farther north on the side of this mountain spur, in E. ½ of N. W. ¼ of S. 31, T. 3, R. 3 E., there shows along the planes of stratification of the sandstones of the capping bluff (*Cliff Rock*) a seam of coal that varies in thickness from 0 to 12 inches. At this point the Mountain Limestone shows some 25 to 30 feet under the coal. In this limestone in S. 30, T. 3, R. 3 E., half a dozen or more caves have been cleaned out in search of two barrels of money reported, by an old Indian tale, to have been hidden somewhere in these mountains.

The *Cliff Seam* of coal under the capping bluff along near the county line is said to be in places in the western part of T. 3, R. 3 E., 18 inches thick and in places in the western part of T. 3 R. 3, E,. from 18 inches to 2 feet in thickness. The coal from these out-crops is used. On the side of the road leading down the mountain in S. 7, T. 2, R. 3 E., there is a thin out-cropping of coal of the *Cliff Seam* under the capping bluff. The intermediate seam of sandstone in the Mountain Limestone, or the *LaGrange Sandstone*, also shows along this road.

II. COAL MEASURES OF JACKSON COUNTY.

The Coal Measures of Jackson county, like those of Madison county, are confined to the tops of mountains, but then the mountains are much broader in this county. These mountains are nothing more than elevated table lands that have been cut and divided up by valleys of erosion. Those to the north of the M. & C. R. R. are still connected or continuous with the great table lands of Tennessee and are known as the *Cumberland table lands* or Cumberland Mountains. Those to the south of the above railroad and to the north of the Tennessee River, form the groups of mountain peaks known as *Gunter's Mountain*. Though they are now disconnected from each other and from the main table lands to the north of the above railroad, by coves and valleys of erosion, they were once but parts and parcels of the same great *table land of Tennessee.*

Those to the south and east of the Tennessee River, known as *Raccoon Mountain*, are nothing more than the extension into Alabama of the Walden Ridge or eastern edge of the table lands of Tennessee, cut in two by the Tennessee River. The plateau areas or Coal Measures of these mountains or of Jackson county were therefore once connected throughout and they formed the entire area of the county; but the Cumberland and Raccoon Mountain areas have, since their deposition, been separated by a fold of the strata, afterwards, eroded into the valley running north-east and south-west, and now occupied by the Tennessee river, and the Coal Measures on both sides of this valley have been so wasted away that they now, all together, do not cover quite half of the area of the county or as much as 500 square miles.

The boundary lines of these Coal Measures along the valleys, coves, etc., are distinctly marked by high abrupt bluffs

that cap the steep mountain sides. For a general description of these Coal Measures or the plateau region of Jackson county, see Introduction.

DETAILS.

A. COAL MEASURES OF THE CUMBERLAND MOUNTAINS.—On Dry Creek, one of the prongs of Larkins' Fork of Paint Rock River, in the southern part of T. 2, R. 3 E., and the northern part of T. 3, R. 3 E., something like the following section occurs:

SECTION IN T'S 2 AND 3, R. 3 E.

(6) COAL MEASURES; including Cliff Rock, etc., 50 to 80 feet.
(5) Coal, 1 to 2 feet.
(4) *Shale*, 2 to 10 feet.
(3) Mountain Limestone, 150 to 200 feet.
(2) *SANDSTONE* (*LaGrange*); fossiliferous, forming a bench, 10 to 20 feet.
(1) *Mountain Limestone*; to bed of creek, 150 to 175 feet.

This Dry Creek has its origin in two large sinks or two small coves, in a north and south line with each other, that together are from three to four miles in length. These sinks extend down into the sub-carboniferous limestones. Under the cross-ridge between the lower of these sinks and the head of Dry Creek, there is a subterranean lake, as can be seen back in the cave known as the *Mouth of the Sinks* or the head of Dry Creek.

In S. 29, T. 3, R. 3 E., there is along the plane of stratification of the *Cliff Rock* a seam of coal from 6 to 12 inches thick. This coal is in waves and in places appears to be squeezed out entirely. The *Cliff Rock* here forms a bluff about fifteen feet in height. On the side of one of the peaks of Keel Mountain, in the N. E. ¼ of S. 30, T. 4, R. 3 E., there occurs the following section:

SECTION OF KEEL MOUNTAIN IN THE N. E. ¼ OF S. 30, T. 4, R. 3 E.

(18) SANDSTONE; massive and slabby, corresponds to the *Upper Conglomerate*, bluff, 50 feet.
(17) *Shale;* clayey, visible, 3 to 4 feet.
(16) *Debris;* gradual slant, may hide coal, 10 to 15 feet.
(15) SANDSTONE (*Cliff Rock*), 30 feet.
(14) *Sandstone;* slabby with some clay iron stone, 3 to 4 feet.
(13) *Sandstone*, COAL; the sandstone is honey-combed and ferruginous, and contains the *coal* in thin seams from the fraction of an inch to two inches in thickness, 2 to 4 feet.
(12) COAL, *Sandstone;* the *coal* has thin partings of sandstone, 3 in. to 1 foot.
(11) *Sandstone*, 4 feet.
(10) *Shale;* ferruginous, 1 foot.
(9) COAL; with much pyrites, 6 in.
(8) *Sandstone*, 5 feet.
(7) *Shale*, COAL; the shale is clayey and carries thin seams of *Coal*, 4 feet.
(6) COAL; with much pyrites, 1 foot.
(5) *Shale*; clayey, just visible.
(4) *Debris;* bench with sink in upper part, 50 feet.
(3) *Mountain Limestone*, 60 feet.
(2) *SANDSTONE* (*LaGrange*); bench, 25 feet.
(1) *Mountain Limestone and St. Louis Limestone*, to foot of mountain, about 800 feet.

From the lower part of the Sandstone (18), there flows, at Dr. Blair's summer residence on the top of this mountain, a bold stream of very cool and strong chalybeate water. At this spring, some thin seams of coal show in the lower part of (18).

On *Split Rock Mountain*, in S's 3 and 10, T. 5, R. 3 E., the *Cliff Seam* of coal crops out in several places 18 inches thick. The *LaGrange Sandstone* forms a bench on the side of this mountain.

On the side of the mountain, in the south-east part of T. 4, R. 3 E., the *Cliff Rock* forms a capping bluff of from 40 to 60 feet in height. The *Cliff Seam* of coal shows itself under this bluff in many places. It is also said to crop out about 12 inches thick, at intervals, for five to six miles to the north-east of this locality, under the capping bluff (*Cliff Rock*) of the south-east edge of the mountain.

The *Belmont Coal Mines*, in S. 1, T. 4, R. 5 E., are in this *Cliff Seam* ot coal. At the time visited, in September, 1880, these mines are said to have consisted of nine drifts. These drifts are arranged along under the capping bluff (*Cliff Rock*) on the south east side of the mountain. They are about 75 feet under the top of the mountain and some 850 feet above the M. & C. R. R., at Limrock or Boyd's Switch about four miles distant. The mouths of these drifts are some 10 feet above a bench along which, in front of the drifts, runs a narrow gauge railroad, some 2½ miles long, to the drum at the head of the incline. The incline is said to be 200 feet long and to have a fall of 500 feet. It ends in a chute over a standard gauge branch railroad out from Limrock or Boyd's Switch. The coal in these drifts is said to range in thickness from I6 inches to 4 feet.

It has near the bottom a parting of fire clay that sometimes gets to be as thick as 3 inches. The mining of this coal in 1880 is said to have cost about $1.00 per ton and that it took about 25 cents extra to get it to market.

Col. J. B. Killebrew of Tennessee, in his special report on the Belmont Coal Mines, in 1878, gives the following as probably a section of the mountain at these mines:

SECTION AT BELMONT COAL MINES IN S. 1, T. 4, R. 5 E.

(9) CLIFF ROCK; estmated, 70 ft.
(8) COAL (*Cliff Seam*), 4 ft.
(7) *Fire Clay*, 4 ft.
(6) *Shales Sandstones*; with probably one or more seams of *Coal* 200 ft.
(5) *Fire Cluy*, COAL, 1 to 3 ft.
(4) *Heavy bedded sandstone*, 25 ft.
(3) *Sandstone*; concretionary, 12 ft.
(2) *Mountain Limestone*, 500 ft.
(1) *St. Louis Limestone*, 100 ft.

The *Cliff Rock* (9), here a hard, massive sandstone, forms a bluff about 40 feet high over the drifts. From the edge of the bluff there is a slant to the top of the mountain of about 35 feet more. In places, at least, there is just under the *Coal* (8) a hard flinty sand stone and just over the coal the

sandstone for several feet is black and shaly. The shale or fire clay underbed is very siliceous. On the side of the mountain, over the Mountain Limestone (2) there are two benches which very probably cover out-crops of the *La Grange Sandstone.*

Col. Killebrew, in the above special report, says: "The main entry has been made on the south-eastern side of the mountain and is driven in N. 70 W., to the distance of 155 feet. At the out crop on the brow of the mountain the seam is 4 feet 4 inches thick. The coal is very hard and cubical, lamellar, semi lustrous, free from pyrite, and has no superior as a shipping coal, in Alabama or any other state. It is no exaggeration to say that a house might be built out of the brick like forms of this coal, which would resist the erosive action of the weather for an ordinary lifetime. This power of the coal to resist the disintegrating influences of the weather manifests itself along the out crops of the seam as at the foot of the Cliff Rock, where it remains hard and compact, though exposed for long ages to the crumbling influences of frost and rain. In point of hardness it is a very remarkable coal. Prof. Lupton asserts that it is the hardest coal that he has ever analyzed. It burns with a cheerful blaze and emits radiant gas jets, which suggests the possibility of its value for making gas.

"At the distance of 90 feet from the mouth of this entry, there is a swell or roll in the botton of the mine without a corresponding one at the top. This swell pinches the coal down to 3 feet. After passing this short swell or wave, the coal begins to thicken, so that at 155 feet, the distance to which the entry has been driven, it is 39 inches thick with a tendency to an increased thickness as the gangway is extended.

"The gangway is not entirely horizontal, but has an incline upward, at the rate of about 3 feet in 100 feet, thus securing a natural and inexpensive drainage to the mine. Probably this inclination would be more than enough to answer the purpose of drainage; if so, the gangway might be driven into the right or left, so as to secure any inclination

desired. It is quite probable, however, that after going in 200 feet, the seam will become perfectly horizontal, as it not unfrequently happens that the breaking down of the strata on the slopes of the mountain gives an ascending inclination to the beds of coal at the out-crop.

"In this seam there is a parting of fire clay two inches thick, which occurs thirty-five inches from the roof, and remains parallel to it. Below this fire-clay is a layer of hard cubical coal, which splits into square blocks. This parting of fire-clay proves of great advantage in mining, and renders the use of blasting powder unnecessary. The fire-clay being soft and of a putty-like consistency, is picked out, and the upper and lower layers of coal broken by wedges driven in at the top of the roof, and from the bottom. This method of mining is greatly preferable to blasting, in as much as all the coal comes out in large blocks, and there is comparatively little fine coal.

"After having carefully examined more than 100 coal mines, I can state with the strictest regard to truth, that I have never seen a seam of coal with the same hardness that can be mined so economically, and with such little waste of coal. This seam of fire-clay, so far from being a disadvantage, is of immense value in the economical production of coal.

"The top of the mine consists of layers of shaly sandstone, very hard, and not at all likely to prove troublesome. It shows a smooth, even, hard surface, making what miners call a "*good roof*."

"Beneath the coal is a very hard fire-clay, grayish in color, highly siliceous, difficult to pick, and giving out a ringing metallic sound when struck. It is smooth, except where the swell or wave spoken of occurs. This wave seems to have been shot up into the coal when in a semi-fluid condition, without disturbing in the least the lamination. In examining the coal on the sides of the gangway, I was struck with the almost perfect horizontality of the lamination, and the absence of all plications or "horsebacks." No contortion of laminal was anywhere seen, though, there are occasional

vertical cleavage planes, which give the cubical character to the coal.

"Taking the direction in which the gangway has been extended, it can be carried a mile and a half before it would come to light in a deep gorge on the opposite slope of the mountain. Were it continued in a south-westerly direction, the entry could be driven for several miles through coal. In a north-westerly direction it would meet with no considerable gash in the mountain until it encountered the deep valley of Big Coon Creek, twenty miles distant. Here then is a body of coal covering about thirty square miles, persistent and almost without a break to interfere with mining operations. There are at least two, if not three workable seams. The perfect regularity of the stratification on the sides of the mountain, and the general evenness of the surface on top, lead me to think that no serious plications or strati graphical dislocations will be met with in working the mines.

"Nor does this opinion rest alone upon inferences deducible from the geological indications of the location, but upon facts derived from other explorations. To a practical geologist these additional explorations are conclusive of the fact that no serious faults or disturbances need be expected. Two hundred yards north-east of the entry already described, the seam at the same elevation is exposed forty-six inches thick, with two inches of fire-clay parting. Farther on, one hundred yards, the seam shows fifty-one inches with a fire-clay parting of three inches. Keeping along the south-eastern face of the mountain, 150 yards farther to the north-east, there are seen forty-four inches of coal, and three inches of fire-clay parting. At this opening the fire-clay at the bottom is more distinctly seen, being of a dirty gray color, and very hard after passing the out-crop.

"These openings clearly indicate a remarkable uniformity and persistency in the thickness of the seam, and in the quality of the coal. A mile farther to the north-east the out-crop is said to be five feet thick. It is quite probable that the seam thickens going north, and grows some thinner

towards the south, for an excavation half a mile south-west of the first entry described shows only three feet of coal.

"The general aspects and character of the coal have been mentioned. A fair specimen of this mine was submitted to Dr. N. T. Lupton, of the Vanderbilt University, for analysis. The following is the result:

Moisture	0.91
Ash	4.53
Volatile Matter	39.67
Fixed Carbon	54.89
	100.00

"Prof. Lupton remarks that this coal is of *excellent quality*, very dry, firm and hard, and contains a large percentage of volatile matter, which renders it in all probability eminently suitable for the manufacture of gas. The specimen analyzed showed an entire absence of sulphur or any other hurtful ingredient."

"Mr. Jno. A. Grant, the Supt. of the M. & C. R. R., in a letter written to Mr. F. D. Hurt, of Boyd's Switch, dated Oct. 27, 1877, says:

"I have had the coal from your mine (Belmont) tested as to its adaptability to locomotives, and am pleased to be able to certify to its superiority to any now in use on this road."

In a letter written to the same gentleman by Mr. D. Bryant, of Memphis, he says:

" Some of the mechanics at the shops here (M. & C. R. R.) have seen some of the coal you shipped here, and have asked me to write you, to know if there is any possible chance to get some, say three car-loads, at Boyd's Switch on cars, and at what price. They say it is as good as Pittsburg coal."

Across the mountain, in a northerly direction from this mine, on the south-east side of the gorge of Guess Creek, the *Cliff Seam* is said to be about 3 feet thick on the out-crop and about 7 feet lower than at the mouth of the above mine. On the opposite or north-west side of this gorge in "Phillips Hollow," the same seam of coal is said to be 4 feet thick and to have some 7 feet of *black band ore* over it. This last

out-cropping is most probably of the same locality as the out-cropping of the following section, in the S. E. ¼ of S. W. ¼ of S. 22, T. 2, R. 5 E., obtained from a reliable source:

BLACK-BAND OUT-CROPPING IN THE S. E. ¼ OF S. W. ¼ OF S. 22, T. 2, R. 5 E.

(6) *Sandstone;* roof.
(5) *BLACK-BAND*, 4 ft. 11 in.
(4) COAL *and Slate*, 4 in.
(3) *BLACK-BAND;* slaty, 1 ft. 7 in.
(2) *Sandstone*, 5 ft. 5 in.
(1) *Limestone.*

The above *black-band* (5) is reported to carry about 32 per cent of metallic iron, and is believed to be of the same horizontal position as the Belmont Coal or the *Cliff Seam*, (5) of the Etna Section.

The same authority gives the following as sections of this same *Cliff Seam* of coal in the S. E. ¼ of N. E. ¼ of S. 12, T. 2, R. 4 E.

FIRST, AT MOUTH OF ENTRY.

(5) *Sandstone;* roof.
(4) COAL; dull and lustrous, and quite hard and constant in thickness, 2 ft. 2 in.
(3) *Slate*, 2 in.
(2) COAL; brighter and softer than (4), contains much pyrites and is very variable in thickness, 1 ft. 1 in.
(1) *Sandstone*; ferruginous.

SECOND, FIFTEEN FEET WITHIN, FROM MOUTH OF ENTRY.

(3) COAL, 1 ft. 2 in.
(2) *Slate*, 4 in.
(1) COAL, 1 ft. 1 in.

THIRD, TWENTY FEET NORTH OF MOUTH OF ENTRY, UNDER SHELVING ROCK.

COAL, 1 ft. 11 in.
Slate, 2 in.
COAL, 1 ft. 1 in.

In S. 8, T. 2, R. 4 E., on a *bench* formed by the *LaGrange Sandstone* on the side of the mountain, over 100 feet below the *Cliff Rock*, are to be found some fossil coal plants (*Lepidodendrous*), distinctly marked.

In S. 33, T. 1, R. 5 E., there are some out-croppings of the *Cliff Seam* of coal about 18 inches in thickness. This seam of coal shows also in S. 15, T. 1, R. 5 E., and in S's 5 and 10, T. 2, R. 6 E.

"*Poor House Mountain*" in S. 14, T. 3, R. 6 E., has about the following section:

SECTION OF POOR HOUSE MOUNTAIN IN S. 14, T. 3, R. 6 E.

(14) SANDSTONE, CONGLOMERATE (*Cliff Rock*), 25 to 35 ft.
(13) *Sandstone;* honey-combed, ferruginous and containing streaks of clay iron-stone, 0 to 3 ft.
(12) COAL; waving, 0 to 1 ft.
(11) *Sandstone;* flaggy, hard and cherty looking, 10 to 15 ft.
(10) *Shale;* blue and sandy, with much pyrites and thin seams of clay iron-stone, 3 to 6 ft.
(9) *Sandstone;* very hard and very fine grained; bluish, flinty and calcareous, 1 ft.
(8) *Shale;* sandy, blue and green, with much pyrites, 10 to 30 ft.
(7) *Sandstone;* hard and ferruginous, 1½ ft.
(6) *Sandstone;* flinty and calcareous, ⅓ ft.
(5) *Shale;* yellow with calcareous streaks, 4 ft.
(4) *Limestone;* Mountain Limestone, 75 to 80 ft.
(3) SANDSTONE (*LaGrange*), bench, 20 ft.
(2) *Mountain Limestone*, 200 ft.
(1) *St. Louis Limestone*, 15 ft.

The *Cliff Rock*, (14) of the above section, is here in waves and has in it in places, seams of falsely bedded strata. There are also under the bluffs of this rock numerous rock-houses, that have been worn back in the softer rocks, or in the shaly and flaggy rocks, and are covered with the hard massive rocks. The flagstones (11) of the above section are sometimes of excellent quality and have been quarried and shipped in small quantity. In (8) to (10), inclusive, of the above section, there are several pits or shafts that are known as the *Gallatt gold mines*. They were dug for the *fool's gold* which abounds in these rocks. There also occur some fine springs

along the foot of the *Cliff Rock* bluff of this mountain. There are no pines on the sandy plateau of this mountain, the growth consisting principally of hickory, oak and chestnut.

There are some pines however over the bench on the side of the mountain, and along the foot of the mountain are some noble white oak trees of five feet in diameter.

Under the capping bluff (*cliff rock*) in S. 6, T. 3, R. 7 E., are some thin out-croppings of coal, and a short distance north of Stevenson this *Cliff Seam* is said to be 3 feet in thickness. North of old Boliver, it shows in many places, under the capping bluff, from one to two feet in thickness. In an out-cropping in the S. E. ¼ of S. 29, T. 1, R. 8 E., it is said to be about 25 inches thick. At this point it was drifted into and worked for a short time just previous to the war by the "Huntsville Mining and Manufacturing Company." The coal was carried on a tramway to the M. & O. R. R. at Boliver.

Prof. Safford gives the following as a section of the Coal Measures at the margin of the table land near Anderson Depot, on the N. & C. R. R:

(12) CONGLOMERATE; coming in back of the top oft he cliff formed by the sandstone below.

(11) COAL, *and Shale*; coal, so far as seen, only eight or ten inches thick, 40 ft.

(10) SANDSTONE; heavy, makes the *cliff*, thickness (estimated) 120 ft.

(9) COAL; from 2 to 5 feet of lustrous, black, good coal, more or less laminated by thin leaves of mineral charcoal, contains some pyrite occasionally in seams. Several hundred bushels have been taken from the banks at this point. The coal will, perhaps, average, 3 ft.

(8) *Fire Clay*, 3 ft.

(7) *Shale*, 8 ft.

(6) *Sandstone*, 10 ft.

(5) COAL ; *and Shale* 10 ft.

(4) *Sandstone and Sandy Shale*, 55 ft.

(3) *Shale*, 1 to 6 ft.

(2) COAL; has been opened, a laminated, cubic coal, without pyrite, will average, so far as seen, from 2⅛ to 3 ft.

(1) *Shale*; with clay iron stones, followed below by rocks not seen.

South of the above section, near the State line, the *Cliff Seam* of coal, (9) of the above section, shows in the four out-croppings as in the following sections:

FIRST OR MOST NORTHERN OUT-CROP.

(4) SANDSTONES (*Cliff Rock*); massive above and flaggy below; the flagstones stuck in bluff as if by hand, 120 to 130 ft.
(3) *Shale*, 2½ ft.
(2) COAL; lamellar structure, 1¼ ft.
(1) *Shale*; clayey, with much iron, visible, 4ft.

SECOND OUT-CROP.

(5) SANDSTONE, (*Cliff Rock*); massive bluff, 25 ft.
(4) *Flagstone*, 15 ft.
(3) *Clay Iron-stone*; Sandy and spongy, ⅔ ft,
(2) COAL; lamellar structure. 3 ft.
(1) *Shale*; clayey, with much iron ore, visible, 4 ft.

THIRD OUT-CROP.

(5) SANDSONE *Cliff Rock*; massive, bluff, 30 ft.
(4) *Sandstones*; flaggy and loose in bluff as if packed in by hand, contain much spongy iron ore, 6 to 8 ft.
(3) *Shale*; has much limonite on surface, 3 ft.
(2) COAL; lamellar structure, 1 5-6 ft.
(1) SLATY COAL; just visible.

FOURTH OR MOST SOUTHERN OUT-CROP.

(4) SANDSTONE (*Cliff Rock*); little slabby near bottom, bluff, 50 to 60 ft.
(3) *Sandstone*; ferruginous, little shaly in places, 2½ ft.
(2) COAL; with thin seams of mineral charcoal and much pyrites, lamellar structure, ⅔ ft.
(1) *Shale*; full of coal plants.

The principal growth of the sandy plateau on top of the mountain in this neighborhood is chestnut and chestnut oaks with a few dwarf short leaf pines.

Across the mountain, east of the above sections, on the margin of *Doran's Cove*, near the State line, in the south-west corner of Marion County, Tennessee, there occurs the following out-cropping:

SECTION NEAR THE STATE LINE, IN THE SOUTH-WEST CORNER OF MARION COUNTY, TENNESSEE.

(12) *Coal Measures, Debris*; containing the *Cliff Rock* and doubtless more or less *coal*, 150 ft.
(11) *Sandstone*; flaggy and shaly, 3 ft. 6 in.
(10) *Shale*; sandy and ferruginous, 3 in.
(9) *Clay*, 4 in.
(8) COAL; shaly, 1 in.
(7) *Clay Ironstone*, 1½ in.
(6) *Shale*; sandy ferruginous, 1½ in.
(5) *Clay Ironstone*, 1½ in.
(4) COAL; dull black color, lamellar structure, and contains much pyrites and nodules of a sandy clay iron-stone and and thin irregular streaks of clay; visible 9 feet, said to be 12 ft. 6 in.
(3) *Debris*, 15 ft.
(2) *Coal Measures, Debris*; may have *coal*, 150 to 175 ft.
(1) *Limestone.*

A short distance west of the coal out-cropping of the last section, this same coal shows to a thickness of about 3 feet. This coal is believed to be of the same seam as (4) of the *Etna Section* and (5) of Dr. Safford's section near Anderson's Depot. The seam is very variable in thickness and has thick pockets of coal that in very short distances are squeezed out to nothing.

Just over the ridge or spur, to the north-east of the coal out-cropping of the last section and apparently of about the same altitude, there shows:

(4) *Sandstone*; massive, bluff, 20 ft.
(3) *Clay, Sandstone*. 6 in.
(2) COAL, 8 in.
(1) *Clay*; visible to a depth of several inches.

The *coal* (2) seems to be supplanted in places by shale. In another place on this north-east side of the spur, there shows:

(3) *Sandstone*; massive, bluff, 20 ft.
(2) *Shaly Sandstone*, 6 in.
(1) COAL; weathering into a clayey shaly looking stuff, visible to a thickness of 3 ft., said to have been dug into, 4 ft.

The coals of the last three sections are probably of the same variable seam, (4) *of the Etna Section.* The out-cropping of coal in "*Bedstead Hollow*," one of the hollows leading down into the head of Doran's Cove, are believed to be also of this same seam. The out-cropping of coal on the north side of "Bedstead Hollow" is said to be 3 feet 6 inches thick; that on the south side of the hollow is in the back part of a rock-house, in which there was, in November, 1883, an old furnace and the remnants of what is said to have been an old *scaffold bedstead*, hence the name *Bedstead Hollow.* The old furnace is built of flagstones from the back part of the rock-house and is said to have been here for from 70 to 75 years. The supposition is that a counterfeiter here once mined his coal, made his spurious money and slept. The coal has a lamellar structure and often carries much pyrites. The flagstones of this neighborhood are often well suited for grindstones and whetstones, and are used for head-stones to graves.

The dividing ridge between Doran's Cove and Jefferies' Cove, a small cove running out from the main Doran's Cove towards the north-west, in what is known as *The Narrows*, has been worn down to the mere thickness of the *Cliff Rock.* Across *The Narrows* the Cliff Rock forms a wall some 60 feet long by some 15 feet high and only 2 to 3 feet thick. The approach to *The Narrows* from either end of the spur is, for a long way, not more than wide enough for a wagon-way, with a bluff on each side. This spur appears to be made up as follows:

(4) *Coal Measures*, 350 to 400 ft.
(3) *Mountain Limestone*, 90 to 100 ft.
(2) *LaGrange Sandstone*, 25 to 30 ft.
(1) *Mountain Limestone*, 125 to 130 ft.

The steep sides of the above spur have been stripped of many fine trees of black walnut and chestnut oak.

Near and at the heads of the numerous small coves and hollows running down into Doran's Cove are to be seen many high and beautiful water falls and many huge sinks

and caves that frequently lead down to subterranean streams. These subterranean streams frequently make their appearance at the surface. to flow above ground for only a short distance when they again disappear to come to light again perhaps miles off.

On the high mountain peak or spur between Doran's Cove on the south-west and King's Cove on the north-east, there is said to be out-croppings of coal from 18 to 30 inches in thickness. On the side of the mountain between the State line and South Pittsburg, Tenn., a seam of coal shows in many places 3 feet in thickness. The Coal Measures capping the mountain spur near South Pittsburg have something like the following section:

SOUTH PITTSBURG SECTION.

(9) *Conglomerate* (Upper); scattered over the top of mountain back from edge of bluff.

(8) *Sandstone, Debris;* including the *Cliff Rock* and perhaps some *coal*, about, 150 ft.

(7) COAL (*Battle Creek Seam, Cliff Seam*), 1 ft. 6 in. to 2 ft. 2 in.

(6) *Clayey Shale;* very fossiliferous.

(5) *Sandstone*, 25 to 30 ft.

(4) *Clayey Shale*, 2 to 3 in.

(3) COAL; soft on out-crop, with some clayey partings 2 ft. 6 in.

(2) *Clayey Shale;* just visible.

(1) *Debris, Sandstone;* may hide some *coal*, about 100 ft.

The Coal (3) of the above section corresponds to the thick irregular coal of the hollows around the head of Doran's Cove or to (4) of the Etna Section. In one of its out-crops in the above mountain spur near South Pittsburg, it has the following detailed section:

(3) *Sandstone;* slabby, 25 ft.

(2)
- COAL, 3 in.
- *Sandstone*, shaly, 6 in.
- COAL, 3 in.
- *Shale*, 1½ in.
- *Sandstone;* shaly, 10 in.
- COAL, 2 ft. 6 in.

(1) *Clayey shale;* fossiliferous.

B. Coal Measures of Raccoon Mountain.—The Coal Measures of Raccoon Mountain to the east and south of the Tennessee River are similar in a great measure to those of the Cumberland Mountains. At the *Dade or Cole City Mines*, Georgia, on the margin of the mountain east of Nickajack Creek, the Coal Measures have the following section:

DADE SECTION.

(12) Sandstone (*Cliff Rock Lower Conglomerate*) 75 ft.
(11) COAL (*Cliff Seam*), 6 in. to 2 ft.
(10) *Shale*, 50 ft.
(9) COAL (Dade or Cole City Seam), 1 ft. to 17 ft.
(8) *Shale, Clay*, 45 ft.
(7) COAL (*Red Ash Seam*), 6 in. to 3 ft.
(6) *Fire Clay*, 6 ft.
(5) *Sandstone*, 20 ft.
(4) COAL, 1 ft.
(3) *Sandstone, shale*, 80 ft.
(2) COAL, 10 in. to 1 ft. 2 in.
(1) *Shale*, 40 ft.
Limestone.

The Coal worked at these mines, (9) of the above section, the *Dade or Cole City Seam*, corresponds to the thick irregular coal of the hollows around the head of Doran's Cove or to (4) of Etna Section. It is in the Dade Mines very irregular, ranging in thickness from 1 to 17 feet. The thick pockets of coal do not appear to be in any regular order, though they doubtless occupy the troughs of waves in the underbed strata. It was noticed, in these mines, that the thick pockets of coal had both a shale cover and a shale underbed, while the squeezed out portions of the seam were between sandstones. This shale is black, slick and oily. It divides or splits easily and crumbles badly on weathering, it therefore forms a dangerous or *bad roof* and makes the mining of these thick coal pockets expensive from the necessary use of much propping. This coal is also expensive to mine from the fact that the ridges or waves in the underbed, which cut off or squeeze out the coal, frequently rise so suddenly or are so steep that the coal cars can't be pulled up or over them, and hence to get the coal of the thick pockets beyond these

ridges or crests of waves a great deal ot *dead work* has to be done in tunneling through the hard strata of the ridges or waves. The coal is of good quality; its lamellar structure in the thick pockets is often destroyed by knotty looking places.

Wast of the Dade or Cole City Mines, near the Alabama line, on the edge of the mountain on the south side of the west prong of Nickajack Creek, are the *Castle Rock Mines.* On the side of the mountain at the Castle Rock Mines, there shows something like the following section:

CASTLE ROCK SECTION.

(10) CONGLOMERATE, (*Millstone Grit, Cliff Rock*); 50 ft.
(9) COAL (*Castle Rock Seam, Cliff Seam*), 3 ft.
(8) *Shales*, COAL; the *Coal* in thin sheets in shale, 1 ft. 6 in.
(7) *Sandstone*, 20 ft.
(6) COAL (*Dade Seam*), 1 in. to 1 ft. 6 in.
(5) *Debris;* it likely covers some *coal*, 50 ft.
(4) *Sandstone*, 75 ft.
(3) COAL, 2 ft. 6 in. to 3 ft.
(2) *Coal Measures, Debris*; believed to contain one are more coal seams, 250 ft.
(1) *Mountain Limestone.*

A detailed section of the *Castle Rock Seam*, (9)of the above section, on the out-crop at the mouth of the Drift is as follows:

(7) CONLOMERATE (*Cliff Rock*); the lower 20 feet is here a massive yellow sandstone, 50 ft.
(6) COAL, 8 in.
(5) *Slate*, 2 in.
(4) COAL, 2 ft. 6 in.
(3) *Slate*, ½ to 1 in,
(2) COAL, 10 in.
(1) *Shale*, COAL; coal in thin sheets in Shale, 1 ft. to 1 ft. 6 in.

This coal is also irregular in thickness, from bulges or swells both in the floor and roof and from the interpolation of shale just over the coal seam. The thick coal is however seemingly along in troughs in the underbed, running almost north and south, separated from each other by ridges or

crests of waves. The dip is towards the south. The coal in the bed is very hard and hence hard to mine. It comes out in lumps.

On the side of the Bridgeport and Trenton road down the mountain in the Moore Gap, in S. 14, T. 1, R. 9 E., there is an old drift in the out-cropping of a seam of coal. Under the capping bluff (*Cliff Rock*) to the south.west of the Moore Gap or in the S. E. ¼ of S. 22, T. 1, R. 9 E., there are reported out-croppings of coal about 12 inches thick.

At the mouth of the *Cunningham Old Drift*, in the S. E. corner of S. 27, T. 1, R. 9 E , there is the following section :

CUNNINGHAM SECTION.

(5) CONGLOMERATE (*Cliff Rock, Millstone Grit*), 60 ft.
(4) COAL, 3 in.
(3) *Slate*, 1½ in.
(2) COAL, 1 ft. 4 in. to 2 ft.
(1) *Shale;* visible, 2 ft.

This drift was worked before the war; it is said to be driven for one-fourth mile, and the coal in it to be from a few inches to four feet in thickness. The coal was hauled in wagons down the mountain to the river and loaded on flat-boats. Most of it is said to have been lost in the Tennessee River at the head of Muscle Shoals. It is said to show in many of its out-crops throughout this section of country about three feet in thickness. In this neighborhood, on the plateau north of Long Island Creek, there is said to be out-croppings of a seam of coal over the Cliff Rock or Lower Conglomerate, that sometimes reaches a thickness of 2 feet 6 inches. It is probably the *Sewanee Seam*, (6) of Etna Section.

Along Long Island Creek, the Cliff Rock is near 100 feet in thickness. It forms water-falls along the branches or headwaters of this creek in their descent from the plateau or top of the mountain. Under these water-falls, in several instances at least, are out-croppings of the *Cliff Seam of Coal*. On the side of the mountain south of Long Island Creek, in S. W. ¼ of S. 10, T. 2, R. 9 E , there is a reported

out cropping of coal 12 inches thick; it is probably the *Cliff Seam.*

The *Cliff Seam* shows in several places under the capping bluff (*Cliff Rock*) along the edge of the mountain next to the river below Long Island Creek. The coal in these out-croppings is said to range from one to seven feet in thickness. It was worked in *ante bellum* days, in S. 9, T. 2, R. 8 E., in what is known as the *Caperton or Gibson Mines.* The coal from these mines was hauled in wagons down the mountain to the river, loaded on flat-boats and shipped to Chattanooga, etc. The coal of this neighborhood, or on Raccoon Mountain between Long Island and Raccoon creeks, has the reputation of being thicker than in any other locality on this mountain. In the *Pennington well,* several hundred yards south of the gulch of Long Island creek and a couple of miles from the mouth of this creek, the coal is between three and four feet in thickness.

In S. 16, T. 2, R. 9 E., there is a reported coal out-cropping four feet thick, and in this locality there are said to be several out-croppings of coal away from the edges of the mountain, in some of which the coal is two feet and over in thickness. These out-croppings of coal we refer to are of the same seam as the coal in the Pennington well which is most probably the *Sewanee Seam,* (6) of Etna Section. On top of the mountain, near the DeKalb line, in T. 3, R. 9 E., there are several out-croppings of coal from six to eighteen inches in thickness. These out-croppings of coal are some 50 feet over the Lower Conglomerate and hence are also probably of the Sewanee Seam. Coal is said to crop out in S's 1 and 12, T. 3, R. 8 E., which is more than probably of the same seam. The growth over the top of the mountain hereabouts consists principally of blackjack oaks, post and red oaks, with some pines, hickories, chestnut, etc.

Along Rocky Branch, in the S. E. ¼ of S. 4, T. 4, R. 8 E., we find the following section:

ROCKY BRANCH SECTION.

(18) CONGLOMERATE (Upper); scattered over surface.
(17) *Sandstone, debris;* 30 ft.
(16) *Sandstone*, COAL; the sandstone is shaly and carries thin, irregular seams of *coal*, 4 in.
(15) *Clayey shale, clay;* 2 ft.
(14) COAL (*Armstrong Bank*), 8 in. to 1 ft.
(13) *Clay;* fossiliferous, 1 ft.
(12) *Debris;* likely sandy shale, 15 ft.
(11) *Shale;* sandy, visible, 4 ft.
(10) *Sandstone*, COAL; the sandstone is shaly and carries the coal in thin seams, 1 ft. 6 in.
(9) COAL (Sewanee), 4 in. to 10 in.
(8) *Clay;* fossiliferous, just visible.
(7) *Debris;* likely sandy shale, 30 to 40 ft.
(6) CONGLOMERATE (*Cliff Rock, Millstone Grit*); flaggy near top, 80 to 100 ft.
(5) COAL, 4 to 6 in.
(4) *Slate*, 1 to 2 in.
(3) COAL; poor, containing much pyrites. visible above water, 1 ft. 3 in.
(2) COAL, *Slate;* felt under water to bottom of hole, 6 in.
(1) *Debris.*

The *Cliff Seam*, (2) to (5) inclusive, of the above section crops out in the back part of a rock-house, under a clear water-fall of some 30 feet.

The strata in many places in the creeks on the mountains, in this vicinity, are seen to be in waves, usually from north-west to south-east, and carry falsely bedded seams. Scattered along the road leading down into Jones' Cove, in N. E. ¼ of S. 28, T. 4, R. 7 E., there is considerable limonite. Some of the boulders of this ore are several feet in diameter. It doubtless comes from the out-croppings of a seam near the base of the Coal Measures. Jones' Creek on the mountain is called Bryant's Creek and is put down on the maps as Riley's Creek. On the south side of the gorge of Jones' Creek, there are many out-croppings, under the capping bluff, of the *Cliff Seam* of coal, 18 inches in thickness. On the mountain in S. 26, T. 4, R. 7 E., there are out-croppings of coal which are likely of the Sewanee Seam. The growth on the mountain here consists of a few hickories with spots

of white and post oaks and spots of pine. The pasturage is very fine indeed during the summer months. Crossing the road up the mountain from Hitch's Ferry, in the N. W. ¼ of S. 31, T. 4, R. 7 E., about half-way up the mountain, in the Mountain Limestone, is a seam about six inches thick of very impure hard cubical slaty coal.

On the mountain, at the *Stoner Coal Bed*, in the S. W. ¼ of S. W. ¼ of S. 32, T. 4, R. 7 E., there is the following section:

STONER SECTION.

(9) *Debris;* loose Conglomerates, etc., to level of plateau, 20 ft.
(8) CONGLOMERATE (*Upper*), 20 ft.
(7) *Flagstones*, *Debris*, 10 ft.
(6) COAL (*Sewanee*); at chalybeate spring, 6 in.
(5) *Clayey Shale;* fossiliferous, 4 ft.
(4) *Sandstone;* massive, reddish, 15 ft.
(3) CONGLOMERATE (*Cliff Rock*), 60 to 75 ft.
(2) *Sandstone*, *Shale*, COAL; the sandstone and shale carry the coal in thin streaks, 1 ft. 6 in.
(1) *Debris.*

There is said to be other out-croppings of coal similar to the above in this locality. On the top of the mountain, not far from the edge, in N. W. ¼ of S. 1, T. 5, R. 6 E., there is a large pond or sink, an usual sight.

At Fern Cliff P. O. on the brow of the mountain in the N. W. ¼ of N. W. ¼ of S. 12, T. 5, R. 6 E., there is the following out-cropping:

FERN CLIFF SECTION.

(11) *Debris;* loose Conglomerates, etc., to top of mountain, 15 ft.
(10) CONGLOMERATE (*Upper*), 15 ft.
(9) *Debris*, 25 ft.
(8) COAL (Sewanee); said to be several feet thick, visible to a thickness of 1 ft. 3 in.
(7) *Clay;* just visible.
(6) *Debris;* likely clayey shale, 4 ft.
(5) *Sandstone;* massive, reddish, 18 ft.
(4) CONGLOMERATE (*Cliff Rock*), 30 ft.
(3) *Debris;* doubtless hides *Cliff Seam*, 20 ft.
(2) *Sandstone*, 15 ft.
(1) *Debris.*

In the above section, the *Cliff Seam* does not show itself, though there runs from out of the debris just under the Conglomerate (4) a chalybeate spring which doubtless has its origin in this seam of coal. The *Cliff Seam* shows just south of the above locality under the "*Durham Bluff*," as follows:

DURHAM BLUFF SECTION, No. 1.

(4) CONGLOMERATE (*Cliff Rock*), 60 ft.
(3) COAL; with much pyrites, 3 ft.
(2) CONGLOMERATE; visible, 1 ft. 3 in.
(1) *Debris*.

The three feet of coal (3), in the conglomerate, thins out to nothing in three to four feet to the south, and in six to eight feet to north is squeezed out to the fraction of an inch. For several feet up in this Lower Conglomerate, from its base, there run streaks of hard cubical coal, filling up cracks in the conglomerate. These thin coal seams are usually in waves with the rocks and are commonly parallel to the stratification of the rocks, but sometimes they run at angles to this stratification and sometimes even perpendicular to it. The thicker of these coal seams in the hard conglomerate sometimes divide up into many coal streaks and sometimes many coal streaks unite and make a thin seam. Strange to say, the thickest portions of these thin coal seams are usually over the crests of waves where they sometimes are from four to six inches thick. In another place under "Durham Bluff," farther to the south, there shows the following outcropping:

DURHAM BLUFF SECTION, NO. 2.

(6) CONGLOMERATE (*Cliff Rock*), 60 ft.
(5) COAL; irregular, waving, 2 in. to 1 ft.
(4) *Sandstone*, *Shale*, COAL, the sandstone carries the coal in thin sheets, 6 in.
(3) *Shale*, COAL; the coal in thin sheets in the shale, the shale also has in it much limonite and pyrites, 4 ft.
(2) *Shale;* with much *black band* and some limonite seams and nodules of clay iron-stone and pyrites, almost a solid seam of iron ore, 4 ft.
(1) *Debris*.

On the brow of the mountain, over the *Upper Conglomerate*, there are scattered over the surface, in N. W. ¼ of S. 15, T. 5, R. 6 E., boulders of spongy sandy limonite. In this same quarter section, the *Cliff Seam* shows as a thin seam of coal mixed with slate, and in the S. E. ¼ of S. 16, T. 5, R. 6 E., there occurs the following section:

SECTION IN S. E. ¼ of S. 16, T. 5, R. 6 E.

(5) CONGLOMERATE (*Cliff Rock, Millstone Grit*); roof to rock-houses, with some limonite in spots and seams near the bottom, 50 ft.

(4) *Flagstones;* in regular layers, in back parts of rock-houses, carrying much pyrites which give rise to several fine chalybeate springs, 10 ft.

(3) *Shale*, COAL; the shale is sandy with the *coal* in thin streaks through it; this shale has also on the out-crop much limonite and copperas, 1 ft.

(2) *Shale;* with concretionary balls of concentric rings of limonite, visible, 4 ft.

(1) *Debris.*

The conglomerates of this last section have frequently been cut out into millstones, for which purpose they are said to be well suited.

At the old drift known as the "*Chatton's Mine*," on the side of the road down the mountain in the N. W. ¼ of S. 21, T. 5, R. 6 E., there is the following section:

CHATTON SECTION.

(6) *Debris*; loose conglomerate, etc., to level of plateau, 30 ft.

(5) CONGLOMERATE (*Upper*); 25 ft.

(4) *Sandstone;* slabby, 10 ft.

(3) COAL (*Sewanee Seam*), 1 ft. to 1 ft. 6 in.

(2) *Shale*, COAL; the coal in thin streaks in shale, 4 ft.

(1) CONGLOMERATE (*Cliff Rock*).

In the "Caldwell Gap" in S. W. ¼ of S 29, T. 5, R. 6 E., there is the following section:

CALDWELL GAP SECTION.

(7) CONGLOMERATE (*Upper*) 30 to 35 ft.

(6) *Flagstones*, 20 ft.

(5) *Sandstones;* with much limonite and copperas on surface, 6 to 8 in.

(4) COAL (*Sewanee Seam*); with much pyrites, 1 ft. 6 in.

(3) *Clay;* visible, 2 ft.

(2) *Debris*, 3 ft. 6 in.

(1) CONGLOMERATE (*Cliff Rock*).

The flagstones (6) are from six to eight inches in thickness and can be split with wedges like wood. On the mountain, in a branch in the S. W. ¼ of S. 19, T. 5, R. 6 E., near Mr. E. M. C. Harris, there is an out-cropping of coal which is reported to be eight inches thick. It was covered with water at the time visited and there showed no bedded rocks near it. It is however believed to be 20 to 25 feet under the *Upper Conglomerate* or to be of the same seam as the *coal* (4) of the above section.

On the high spur, in the south-east corner of the county between Subbett's Cove on the north and "*Buck's Pocket*" on the south, there is a very large sink. It is nearly a mile long from east to west, about one-fourth mile wide from north to south and some 125 feet deep, extending down through both the Upper and Lower Conglomerate of about fifty feet each in thickness. On the steep slopes of this spur, on both sides under the Lower Conglomerate, there is much loose limonite. This ore probably comes from the out-cropping of a seam just under the Lower Conglomerate. There is also on the brow of this spur, on both sides, blocks of loose conglomerate, 60 ft. x 60 ft. x 60 ft., that have split off from the cliff of the Upper Conglomerate. These blocks have split off by their weight, their support in the underlying softer rocks, having been weathered away. Some of these blocks have worked their way down the side of the spur to a greater or less distance while others are still in contact with the parent bluff at the bottom but separated from it at the top. On the Sublett's Cove side of this spur, in S. W. ¼ of S. 14, T. 6, R. 6 E., there is the following out-cropping:

SUBLETT'S COVE SECTION.

(7) *Debris;* to top of spur, 25 to 30 ft.
(6) CONGLOMERATE (*Upper*), 50 to 60 ft.
(5) COAL (*Sewanee Seam*), 1 to 1 ft. 6 in.
(4) *Slaty* COAL; visible, 8 in.
(3) *Debris,* 8 ft.
(2) CONGLOMERATE (*Cliff Rock*); pebbles mostly in patches, 50 to 60 ft.
(1) *Debris.*

This coal on the out crop appears to dip 15° to 20° to south-east.

On the opposite or "Buck's Pocket" side of the spur, near the school-house in N. E. ¼ of S. 22, T. 6, R. 6 E., there is the following section:

BUCK'S POCKET SECTION.

(5) CONGLOMERATE (*Upper*), 50 to 60 ft.
(4) COAL (*Sewanee Seam*); good, visible, 1 ft.
(3) *Debris*, 10 ft.
(2) CONGLOMERATE (*Cliff Rock*), 50 to 60 ft.
(1) *Debris*.

As will be seen from an inspection of the last four sections, the *Cliff Seam* does not show in either one of them. Some signs of it, doubtless could be found under the debris at the foot of the Lower Conglomerate.

3. COAL MEASURES OF MARSHALL COUNTY.

The Coal Measures of this county are divided into three parts by "Brown's Valley" and the Tennessee River. The portion on Raccoon Mountain, to the south-east of Brown's Valley, is estimated at about 250 square miles, and the portions to the north-west of this valley on Sand Mountain south of the Tennessee River and on Gunter's Mountain to the north of this river, at about 70 square miles each.

For a general description of these Coal Measures and of the plateaus formed by them see Introduction.

DETAILS.

A. COAL MEASURES OF RACCOON MOUNTAIN.—There are said to be numerous out-croppings of coal, from five to six inches thick, under the second bluff of the mountain between South Sauta and Town Creeks. This coal is probably of the *Sewanee Seam.*

At Jno. Crutcher's mine on Short Creek, about in S. 8, T. 7, R. 5 E., there is something like the following section:

CRUTCHER SECTION.

(8) CONGLOMERATE (*Cliff Rock*), 75 to 100 ft.
(7) COAL (*Cliff Seam*), 1 to 1 ft. 6 in.
(6) *Shale*, 1 ft. 6 in.
(5) *Sandstone*, 2 ft. 6 in.
(4) *Clay*, 2 to 3 ft.
(3) *Sandstone*, COAL; in thin seams in lower part of sandstone, 2 ft.
(2) *Shale*, 3 to 4 ft.
(1) *Debris;* conglomerate, sandstone, etc., to creek, one-third of mountain.

The following section on Short Creek, given by Prof. Tuomy, is most probably of the same seam as the *coal* (7) of the above section:

SHORT CREEK SECTION.

(4) *Sandstone;* forming good roof.
(3) COAL; of good qaulity, 1½ ft.
(2) *Underclay,* 2 ft.
(1) *Sandstone;* forming bed of creek.

Some three-fourths mile to the north-east of the *Crutcher Mine* on "*Mine Branch,*" there is the following out-cropping:

MINE BRANCH SECTION.

(6) *Debris;* to level of plateau, 35 to 40 ft.
(5) CONGLOMERATE (*Upper*), 50 ft.
(4) *Shale*; with much iron, 10 to 12 ft.
(3) *Shale*, COAL; coal in thin streaks in shale, 6 in.
(2) COAL (*Sewanee Seam*), 10 to 12 ft.
(1) *Shale*, COAL; coal in thin streaks in shale visible, 10 to 12 in.

Where Scareham Creek runs into Short Creek about in S. 14, T. 8, R. 4 E., there shows the following section:

SCAREHAM SECTION.

(5) CONGLOMERATE (*Upper*), 75 to 80 ft.
(4) *Debris;* doubtless hides the coal of the last section, 50 ft.
(3) CONGLOMERATE (*Cliff Rock*), 80 to 90 ft.
(2) COAL (*Cliff Seam*), 1 to 1 ft. 6 in.
(1) *Debris*; loose conglomerates, etc., 100 ft.

On Cedar Branch, some three-fourths mile to the east of the locality of this last section, there shows the following out-cropping:

CEDAR BRANCH SECTION.

(5) CONGLOMERATE (*Upper*); visible, 25 ft.
(4) *Debris*, 10 to 15 ft.
(3) COAL (*Sewanee Seam*), 10 to 15 in.
(2) *Clay*, 3 to 4 in.
(1) COAL; under water, felt to a thickness of, 1 ft. 3 in.

Under the water-fall of Scareham and Whippoorwill creeks just as they come together and fall over the *Lower Conglomerate*, there is said to be an out-cropping of coal. It is of course of the *Cliff Seam*.

Short Creek as it runs over the Lower Conglomerate, in S. 22, T. 8, R. 4 E., forms a clear water-fall of about 30 feet. The upper strata of the cliff which forms this water-fall are very hard conglomerates and under them there are softer strata that have been denuded until there is beneath and behind the over-flow of water a comparatively dry *rock-house.* Just west of this water-fall, there is on the side of the road the following out-cropping:

SECTION IN S. 22, T. 7, R. 5 E.

(4) *Sandstone;* may be the *Upper Conglomerate,* 60 to 70 ft.
(3) *Sandstone,* COAL; coal in thin seams in sandstone, 4 ft.
(2) COAL; waving and irregular, out-crop, 4 to 6 in.
(1) *Shale, Sandstone,* 20 ft.

On the side of the Rome Ga., road as it ascends the mountain in "*Pole Cut Hollow,*" about in S. 7, T. 8, R. 4 E., there shows the accompanying section:

POLE CAT HOLLOW SECTION.

(7) *Debris*; to top of mountain, 200 to 300 ft.
(6) CONGLOMERATE (*Lower*); visible, 7 ft.
(5) COAL, *Slate,* 3 in.
(4) *Fire Clay,* 6 in.
(3) *Slate,* COAL, 3 to 4 in.
(2) *Slate,* 2 in.
(1) COAL; visible to a thickness of 1 ft.

The strata of the above section are believed to be in a slide. The coal of this section is thought to be the same as that which is said to occur at the *Old Derrick Spring,* of which a reliable authority gives the following section:

DERRICK SPRING SECTION.

(5) *Sandstone,* 10 ft.
(4) *Clay Slate,* 5 ft.
(3) COAL and *Slate*; in thin laminal, 4 ft.
(2) COAL; hard and bright, 11 in.
(1) *Clay;* underbed.

This out-cropping of coal is said to be only ten feet higher than the Guntersville Court House, hence it must be in a slide.

In a cove, in S's 23 & 26, T. 8, R. 3 E., not very far from the foot of the mountain, there is considerable limonite. In places, it seems to be almost in ledges. It is mixed with debris of the Coal Measures and most probably comes from the seam that crops out near the base of the Coal Measures.

The crest of the mountain where it is ascended by the Gadsden or Turnpike road in S. 27, T. 8, R. 3 E., is about 350 feet above Big Spring Creek. The strata at this point are very perceptibly in waves from N. W. to S. E. In the wells near the county line in S. 11, T. 10, R. 4 E., there is said to be a seam of about three feet in thickness.

In a spring in the N. W. ¼ of S. 12, T. 10, R. 4 E., there is an out-cropping of coal that is reported to have been dug into to a depth of 18 inches without getting through it. This coal and that in the wells are most likely of a seam between the conglomerates, perhaps the Sewanee Seam.

Along the Gadsden road up the mountain in the N. W. ¼ of S. 25, T. 9, R. 2 E., near Big Spring P. O., there occurs the following out-crop:

SECTION IN N. W. ¼ OF S. 25, T. 9 R. 2 E.

(7) *Sandstones*, CONGLOMERATE (*Upper*), 60 ft.
(6) COAL, 10 to 12 in.
(5) *Clay*, 8 to 10 ft.
(4) *Limonite*; scaly and siliceous, stratified, 3 to 4 ft.
(3) *Debris*, 55 ft.
(2) CONGLOMERATE (*Lower*), *Sandstone*, *Debris*, 140 ft.
(1) *Limestone*, 40 ft.

B. COAL MEASURES OF SAND MOUNTAIN.—On the northwest side of Brown's Valley, only a few out-crops of coal are known of. On this side of the valley, however, there are numerous deposits of limonite near the foot of the mountain. Some of these deposits are of considerable size and contain very good ore. They all probably come from the out-cropping of the seam near the base of the Coal Measures. On top of the mountain, on the head-waters of Price's Creek, one of the head prongs of Mulberry Fork of

Black Warrior River, near the county line, there crops out a seam of coal about as follows:

PRICE'S CREEK SECTION.

(7) *Debris;* to level of plateau, 80 ft.
(6) *Sandstone;* massive and flaggy, 5 ft.
(5) *Shales, Sandstones,* 4 ft.
(4) COAL; variable, 5 to 6 in.
(3) *Shale,* 2 in.
(2) COAL 4 to 5 in.
(1) *Clay.*

This coal, it is believed belongs between the two conglomerates.

Mink Creek in its descent from the top of the mountain, as, it passes over the two conglomerates in S. 22, T. 8, R. 2 E. has two perpendicular falls of from 30 to 40 feet each within 50 to 75 yards of each other. In the bluff of one of these falls, there is said to be a seam of coal two inches thick.

There is a reported coal out-cropping in S. 11, T. 8, R. 2 E., on Beech Creek above *the falls.* It is probably between the two conglomerates.

In the vicinity of Arab P. O., in N. E. ¼ of N. E. ¼ of S. 26, T. 8, R. 1 E., there are out-croppings of a seam of red and mullatto plastic clay that is used for making jars, etc.

At Gilliam's Spring, in N. E. ¼ of N. E. ¼ of S. 23, T. 8, R. 1 E., near the county line, there is said to be a seam of coal in a soft blue slate.

On Shoal Creek, in S. 21, T. 7, R. 2 E., is a reported out-cropping of coal, from eight to twelve inches thick, under the *Lower Conglomerate* (*Cliff Seam*). This creek also makes two beautiful falls as it pours over the two conglomerates. There is also a reported out-cropping in the eastern part of S. 23, T. 7, R. 1 E., on the head-waters of Shoal Creek. It is probably of a seam above the two conglomerates.

It is stated on good authority, that at Mr. Hill's in T. 8, R. 2 E., there occurs the following section:

HILL'S SECTION.

(5) CONGLOMERATE (*Lower*), *and Sandstone* 90 ft.
(4) *Slate*, COAL ; the slate is gritty and fossiliferous, it contains the coal in occasional thin streaks, 4 ft. 6 in.
(3) COAL, *Slate*; in layers, 6 in.
(2) COAL; soft and full of pyrites, 5 in.
(1) *Sandstone, Debris.*

Some 200 yards north of the above out-cropping and fifty feet higher than the *coal* (2), the same authority states that there is in the conglomerate a seam of very hard coal that varies in thickness from 0 to 5 inches and that alternates with a honey-comb mass of limonite.

There is a reported thin shaly seam of coal in the wells at Oleander, in S. 22, T. 7, R. 1 E.

In S. 11, T. 7. R. 1 E., there is said to be a coal out-cropping two feet thick that has been worked considerably by the neighborhood blacksmiths. It is most probably of the *Cliff Seam* under the Lower Conglomerate.

The Mountain Limestone is particularly well developed in Beard's Bluff where it is between 400 and 500 feet in thickness, over-laid with about 200 feet of Coal Measures. In the upper part of these limestones, there are seams about 18 inches thick, of almost pure flint, as seen in ledges in front of Judge O. T. Street's residence. There also crops out in the upper part of this limestone on the side of the road leading down to Fort Deposit Ferry a seam of very black bituminous shale about ten inches thick. Scattered over the plateau over the Lower Conglomerate here at Beard's Bluff there is considerable limonite of very good quality. Farther to the west, this limonite seems to get much more siliceous and to occur as ferruginous gravels of a clay iron-stone appearance, scattered over the surface.

C. COAL MEASURES OF THE CUMBERLAND MOUNTAIN SPURS. The Coal Measures north of the Tennessee River or those on Gunter's Mountain, in this county, are badly cut up by deep coves. They are variable in thickness. They sometimes reach a thickness of 250 feet and carry one are more

seams of coal. One of these coal seams is said to be in places between Guntersville and *Paint Rock Bluff* about three feet thick. The LaGrange sandstone that crops out on the sides of the mountains is comparatively thin. The following is a section of a spur of this mountain as it juts up against the Tennessee River, just above the mouth of Paint Rock River, in what is known as "*Paint Rock Bluff.*"

SECTION OF PAINT ROCK BLUFF.

(3) COAL MEASURES; standing upward from the top of the bluff; they likely carry the *Cliff Seam* of coal, from 12 to 14 inches thick, 125 to 150 ft.

(2) *Mountain Limestone*; a dark blue limestone and a bluish gray argillaceous limestone, granular and shaly in places, capped with a hard flinty bluish gray limestone, a perpendicular bluff about 200 ft.

(1) *Debris*; to edge of water, about, 300 ft.

The bluff (2) is streaked or stained in its upper part from the depositions of chalybeate waters and hence the name, "Paint Rock Bluff." In the face of this bluff, near its bottom, are two caverns, whose gaping mouths are from 12 to 15 feet wide, and from 6 to 7 ft. high. They extend back into the bluff some 60 to 70 feet. A fine view is had of the Tennessee River from the top of this bluff, and of this bluff from boats on the river. The LaGrange sandstone is doubtless hid under the debris (1).

On the side of the mountain, just under the Lower Conglomerate or Millstone Grit bluff, in the N. W. corner of S. 8, T. 7, R. 4 E., there is much loose limonite. Just to the north-east of this locality, there was taking place at the time visited, June 16, 1887, a great slide in the softer rocks just under the above conglomerate bluff.

The Mountain Limestone in S. 19, T. 6, R. 4 E., is exposed to a thickness of from 350 to 400 feet. The upper part of it, throughout this section of country, is very cherty or siliceous. Over it, just under the Lower Conglomerate bluff, there is much loose limonite. There issues from this limestone a *big spring*, whose water runs a mill about 1¼ miles farther up in the cove, then sinks, and after running under

the mountain for about one mile, makes its appearance to run another mill almost as soon as it comes to light. There are many of these *big springs* in this limestone along the foot of the mountains, and it is nó unusual thing for them to sink and to come to light again after running greater or less distances under the mountains.

The following two out-croppings are given upon reliable authority as occurring in S. 27, T. 5, R. 4 E.

SECTION I.

(4) *Sandstone;* porous and fossiliferous, 5 ft.
(3) *Slate;* gray and sandy, 5 ft.
(2) COAL, 9 in.
(1) *Clay;* underbed.

SECTION II.

(3) *Slate;* blue and sandy, 35 ft.
(2) COAL; hard and bright, 1 ft 10 in.
(1) *Slate;* hard, underbed.

The coal of this *second out-cropping*, in a well, nine feet below the surface, in the S. E. ½ of S. W. ¼ of S. 27, T. 5, R. 4 E., is reported to be 31 inches thick. It is believed to be of a seam some fifty below the coal of the *first out-cropping.*

4. COAL MEASURES OF MORGAN COUNTY.

The Coal Measures of this county are all connected, though badly cut up by coves. They occupy the northern edge of the elevated plateau of Sand Mountain south of the Tennessee River. This plateau is from 1100 to 1500 feet above tide water level and from 500 to 900 feet above the Tennessee River. The most northern edge is the highest portion of it; the plateau sloping towards the south or south-west with the dip of the strata. The portion within this county, or the Coal Measures of this county, are estimated at about 275 square miles. These measures have a maximum thickness of about 500 feet and as many as two seams of coal. For a general description of these measures or of the plateau region of Morgan county, see *Introduction.*

DETAILS.

Along the Turnpike road or Huntsville and Warrenton road, as it ascends the mountain south of Whitesburg, in S. 12, T. 6, R. 1 W, there occurs the following section:

SECTION IN S. 12, T. 6, R. 1 W.

(8) SANDSTONES, *Shales;* the sandstones cap the mountain and likely correspond to the Upper Conglomerate, 60 ft.
(7) COAL (*Sewanee Seam*), 6 in.
(6) CONGLOMERATES, *Sandstones, Shales;* these conglomerates are of the *Lower Conglomerate or Cliff Rock*, 60 ft.
(5) COAL; (*Cliff Seam*); only a few inches.
(4) *Sandstones, Shales*, 60 ft.
(3) *Mountain Limestone;* about, 330 ft.
(2) *LaGrange Sandstone;* bench, 50 ft.
(1) *Mountain Limestone;* to second bottom, 60 ft.

In the limestone (1) of the above section there are numerous large sinks, caves, and springs. The best known of

the caves is perhaps the "*Ittachoomah Cave*" in the S. E. ¼ of S. 35, T. 5, R. 2 E. This cave extends clear through a spur of the mountain and can be traversed from east to west about one fourth mile. It contains deposits of nitre-earth that were worked during the war. It is also a home for bats and contains considerable deposits of bat-guano. The best known of the springs are perhaps the Cave and Valermoso Springs. The Cave Spring runs from out of a large rock-house in S. E. ¼ of S. 4, T. 6, R. 3 W. It is dammed up into a subterranean mill-pond and runs a mill within sixty feet of its mouth. The Valermoso Springs, in S. 19, T. 6, R. 1 W., are widely known for their medicinal virtues. They consist of a "White Sulphur" or "Iodine Spring," a "Black Sulphur Spring" and a "Chalybeate Spring," all within a circle of ten feet diameter. Their waters are of moderate strength and are quite palatable. The "White Sulphur" or "Iodine Spring" is the most noted of these springs, and its water is said to be an unfailing remedy for rheumatism, consumption, and diseases of the kidneys, stomach, skin and liver. They rise in the limestone just under a bluff, 45 to 50 feet high, of the LaGrange Sandstone upon which the Hotel and cottages are built. Of the sinks, the "Newsome Sinks," in S's 2, 3, 11 and 12, T. 1, R. 1 W., are the most remarkable. These sinks consist of many small sinks within a big one. The big sink is some two miles long from north-west to south-east and about one-fourth mile broad. It extends down through the capping Coal Measures into the Mountain Limestone. It is surrounded by bluffs, especially of the Lower Conglomerate, and under these bluffs there are numerous *rock-houses* and caves, which formerly sheltered and hid the *moonshiners* in their illicit work. From under these bluffs, there issue numerous fine springs, whose waters, together with the rain water caught in the big sink, disappear in the little sinks to appear as *big springs* around the foot of the mountain, usually near the heads of the coves. Coal out-croppings are also said to occur under these bluffs; they are doubtless of the two seams of the last section. The *coal* (7) of that section crops out

in the N. E. ¼ of S. 14, T. 6, R. 1 W.; it is between sandstones and is of very irregular thickness. Its maximum thickness is about 11 inches. As the mountain is descended into a cove of Cataco Creek, about one mile south of the south-east end of "Newsome Sinks," the Coal Measures appear to have a thickness of about 400 feet, with about 300 feet of limestone under it to the level of the cove. Near the head of this cove and at the foot of the mountain, in S. 24, T. 7, R. 1 W., there runs from a cave a *big spring*, which is doubtless the outlet for the waters of "Newsome Sinks." A little farther up in the cove, to the east, is a cave that has been traversed for about one-half mile. It also contains heaps of nitre-earth that were worked during the war. There is also in this cove, along the foot of the mountain, some dry sinks which during freshets, it is said, spout out large volumes of water.

On the head waters of the North Prong of Cataco Creek there occurs on the side of the mountain in S. 11, T. 8, R. 1 W., the following out-cropping:

OUT-CROPPING IN S. 11, T. 8, R. 1 W.

(13) *Debris*; gradual slant to top of plateau, 40 to 50 ft.
(12) *Bluff;* probably Upper Conglomerate, 15 to 20 ft.
(11) *Sandstones, Shales, Debris;* 110 ft.
(10) CONGLOMERATE (*Cliff Rock*); massive bluff around cove, 25 ft.
(9) *Sandstones*; flaggy and wavy, probably a conglomerate in places, 15 ft.
(8) COAL, (*Cliff Seam*); very irregular in thickness, though hard and good, 6 to 8 in.
(7) *Sandstone*, COAL; the sandstone carries the coal in thin sheets, ½ in.
(6) COAL; slaty, 1½ in.
(5) *Shale;* black and fossiliferous, 3 ft.
(4) COAL; slaty, 10 in.
(3) *Sandstone, Shale,* 8 to 10 ft.
(2) *Debris*, 20 ft.
(1) *Limestone;* to level of cove, about, 200 ft.

On the mountain not far from the above out-crop, there is a large sink. The *Sewanee Seam* is doubtless covered by the debris of (11) of the above out-cropping, as it crops out some

four to five feet above the Lower Conglomerate on a branch in S's 13 & 24, T. 8, R. 1 W.

The *Cliff Seam* of coal is said to show in out-crops under bluffs in S. 36, T. 7, R. 2 W.

Mineral tar or *liquid bitumen* oozes up from debris, overlying Mountain Limestone, in a ditch near the foot of the mountain in S. 15, T. 8, R. 3 W. This mineral tar or liquid bitumen, after exposure, looks like the pitch from an old wagon hub. From this, so called, *Tar Spring*, there were dug out some calcite crystals, stuck together by tne waxy matter.

On Flint Creek, in the S. W. ¼ of S. W. ¼ of S. 33, T. 8, R. 3 W., there is the following out-crop.

FLINT CREEK OUT-CROP.

(12) *Soil, Sandstone*, 20 ft.
(11) *Debris*, COAL; the coal reported to be near the top and to be six inches thick, 40 ft.
(10) CONGLOMERATE, *Sandstone;* this is the *Upper Conglomerate*. 50 ft.
(9) COAL, CONGLOMERATE; the coal is in ten or more seams, each from 0 to 2 inches thick, through the conglomerate, 10 ft.
(8) *Debris*, 40 ft.
(7) CONGLOMERATE, SANDSTONE; this is the *Lower Conglomerate*, 50 to 60 ft.
(6) *Clay*, 2 to 3 in.
(5) *Shale*, COAL; the shale is of a dull black color like *mother of coal*, and carries the coal in thin irregular seams, 5 ft.
(4) *Debris*, 10 ft.
(3) COAL; reported.
(2) *Debris*, 12 to 15 ft.
(1) *Mountain Limestone*.

The thin seams of coal of (9) were seen in one place to have collected together into a seam varying from six to fourteen inches in thickness, and which is said to be in another place 2 feet 6 inches thick.

South of Wilhite station, on the side of the L. & N. R. R., in the S. E. ¼ of S. 31, T. 8, R. 3 W., the *coal* (5) of the above section has been driven into for a few feet. It is only two to three inches thick and is covered by from four to six feet

of black shale which carries thin streaks of coal. Some sixty feet above this out-crop, another thin coal seam was dug into. It is probably of (9) of the above section.

There is no coal known in this county west of the L. & N. R. R., though the Coal Measures are in places as much as 250 feet in thickness. Just to the west of the above railroad, they are about 200 feet thick, and in Day's Gap, in S. 25, T. 8, R. 5 W., and Basham's Gap, in S. 32, T. 8, R. 5 W., they are from 220 to 225 feet thick.

5. COAL MEASURES OF LAWRENCE COUNTY.

The Coal Measures of Lawrence county occupy the summit of the plateau, which along the southern edge of the county rises some 350 feet above the Moulton Valley. They extend clear across the county from east to west and from three to eight miles up in the county from the south. They are most elevated along the northern edge or crest of the mountain and slope towards the S. S. W. from this edge, which forms the divide between the waters that flow south into the Warrior River and those that flow north into the Tennessee River. They cover about 160 square miles and are from 100 to 300 feet in thickness. They carry no known commercially workable seams of coal, though on many of the branches or creeks, there are coal out-crops from one sixteenth of an inch to ten inches in thickness, and, in a few places, to nearly 2 feet in thickness.

DETAILS.

The Coal Measures show on the side of the mountain, in the S. W. ¼ of S. 7, T. 8, R. 6 E., a thickness of about 250 feet, and in S. 19, T. 8, R. 6 W., and S's 4 & 30. T. 8, R. 7 W., coal out-croppings, and, near the top of the mountain in S. W. ¼ of S. 30, T. 7, R. 7 W., a coal out-cropping that is said to be from 8 to 10 inches thick.

At Cave Spring, in the N. E., corner of S. 26, T. 8, R. 6 W., the head of the Capses or Tar Spring Creek, the Lower Conglomerate forms the cover to a rock-house: It here has a dip to the N E., from a wave in the strata, though just to the west of the spring the dip is about 20° to the S S W. A short distance below the cave spring, the branch has cut through the Coal Measures down into the underlying crenordal limestones. These limestones or sub-carboniferous

strata, down near the Tar Spring, in the N. W. ¼ of S. W. ¼ of S. 26, T. 8, R. 6 W., show to a thickness of 40 to 50 feet above the bed of the creek, and are said to show on down the creek for a distance of some two miles before becoming covered up by Coal Measures. On this creek in the N. E. ¼ of S. 33, T. 8, R. 6 W., there is said to be under a bluff and between hard rocks, a seam of coal about 9 inches in thickness. It is probably just under the Lower Conglomerate.

Signal Mountain, in the N. W. ¼ of S. W. ¼ of S. 1, T. 8, R. 6 W., is a high projecting point out to the north from Sand Mountain, that was used as a signal station by U. S. topographical engineers. It is capped with Coal Measures, that have been separated by denudation from those of the divide or of Sánd Mountain on the south. There is said to be a thin seam of coal under the bluff of the Lower Conglomerate that caps this high point.

Just to the east of where the Penitentiary Mountain, a spur of Sand Mountain, leaves the Sand Mountain, i. e., in the S. W. ¼ of N. W. ¼ of S. 13, T. 17, R. 8 W., there is an out crop of coal near 2 feet in thickness. This coal shows for some distance under a bluff and has been considerably dug by the neighborhood blacksmiths. To the west of this out-cropping about one-fourth mile, in S. E. ¼ of N. E. ¼ of S. 14, T. 7, R. 8 E., there is the following out-crop of the same seam of coal.

OUT-CROP IN THE S. E. ¼ OF N. E. ¼ OF S. 14, T. 7, R. 8 E.

(7) *Capping Bluff;* Lower Conglomerate, 15 ft.
(6) *Debris*, 10 ft.
(5) *Sandstone, Shale;* the shales in thin partings, 4 ft.
(4) COAL; seemingly good, about, 1 ft. 10 in.
(3) *Shale;*, blue, just visible.
(2) *Debris;* about, 40 ft.
(1) *Mountain Limestone.*

The dip is a few degrees to the S S W. The coal in the bed appears quite pure, though it is said to give on analysis a large amount of Sulphur. It is said to crop out also in a ravine to the south of the divide.

On the head waters of Brushy Creek, in the N. W. ¼ of S. 25, T. 8, R. 8 W., there is the following out-crop:

BRUSHY CREEK OUT-CROP.

(5) *Debris*; to level of plateau, 60 to 70 ft.
(4) CONGLOMERATE (*Lower*); very massive, 40 ft.
(3) COAL (*Cliff Seam*), ½ in.
(2) *Debris*; with iron concretions, 50 ft.
(1) *Sandstones*; slabby and fine grit, along bed of branch with chalybeate and limestone springs.

The *coal* (3) of the above section is said to appear in out-crops on Ivey Branch, in the S. E. corner of S. 34, T. 8, R. 8, W. from six to eighteen inches thick. It also shows in the N. E. ¼ and N. W. ¼ of S. 35, and in S. W. ¼ of S. 22, all of T. 8, R. 8 W.

The Coal Measures have been cut through and the Mountain Limestone exposed to a thickness of some 40 feet in the deep ravines along the principal branches of Sipsey River in T. 8, R's 8 & 9 W. These exposed limestones extend south ward to within about one mile of the county line when they finally become covered by the Coal Measures.

At Hall's Mill, in the S. E. ¼ of S. 32, T. 8, R. 9 W., there is the following out-crop:

HALL'S MILL OUT-CROP.

(3) CONGLOMERATE (*Upper*); over the plateau, soft and friable on weathering, whitish and pinkish, 20 ft.
(2) *Sandstone, Shale, Debris*, 160 to 170 ft.
(1) CONGLOMERATE (*Lower*); very massive with divisions of shales and sandstones in upper part, 50 to 60 ft.

The Lower Conglomerate of this, section forms a bluff about 50 feet high and over it, just above the mill, there is a clear water-fall of about 30 feet. A dam of a few feet in height, of loose rocks, is thrown across the creek just above the water-fall. This mill is within one-half mile of the head of the creek, which is fed by large springs that always furnish plenty of water.

In "*Elbow Hollow*," so named from a crook in a chestnut tree, there is in the N. E. ¼ of S. 8, T. 8. R. 9 W., the following out-crop:

ELBOW HOLLOW OUT-CROP.

(4) *Debris;* to level of plateau, some, 200 ft.
(3) *Sandstone*, 8 ft.
(2) COAL; good and hard with much mineral charcoal, 6 in.
(1) *Shale*; bluish.

The Lower Conglomerate is covered by the *Debris* (4) of the above section and the *Coal* (2) must be 30 to 40 feet under this conglomerate, and is probably the *Dade Seam.*

On Tedford Creek, in the N. E. ¼ of S. 15, T. 8, R. 9 W., there is the following out-crop:

TEDFORD CREEK SECTION.

(4) *Debris*; covering *Lower Conglomerate*, some 250 ft.
(3) *Sandstone;* bluff with small *rock-houses*, 10 ft.
(2) *Debris;* covering coal of last section, 5 ft.
(1) *Mountain Limestone*; light gray with black specks, fossiliferous, to bed of creek, 35 ft.

From under the *limestone* (1) there issues a *big spring* of cool water which within 200 to 300 yards, falls into sinks.

On Panther Branch, in the S. W. ¼ of S. 2, T. 8, R. 9 W., there is the following out-crop:

PANTHER BRANCH OUT-CROP.

(5) *Debris*; covering *Lower Conglomerate*, some 200 ft.
(4) *Sandstone*; bluff with small rock-houses, 10 ft.
(3) COAL; covered up when visited, but has been dug considerably by neighborhood blacksmiths, said to be 8 in.
(2) *Debris, Sandstone*, 20 ft.
(1) *Mountain Limestone*; to bed of branch 20 ft.

The *sandstone* (4) of the last two sections and (3) of the *Elbow Hollow Section*, can be seen as a bluff with small rock-houses under it in all of the deep hollows hereabouts, and the *Lower Conglomerate*, in loose boulders, shows high

up on the sides of the hills. The coal of the above sections is said to show also in the S. W. ¼ of S. 11, T. 8, R. 9 W., and the S. E. ¼ of S. 36, T. 7, R. 9 W. There is a reported *salt-peter cave* in a large *rock house* in the S. E. ¼ of S. 3, T. 8, R. 9 W. From the description given of it, the back of this *rock-house* must be of the same horizon as the above coal. Salt-peter is said to have been made from the earth of this rock house during the war.

Along the road down the mountain in the *Steenson Gap*, in S. 28, T. 7, R. 9, 7 W., there is the following out-crop.

STEENSON GAP SECTION.

(10) *Debris*; partly *Drift*, to level of plateau, about 50 ft.

(9) SANDSTONES, *Debris*; the sandstones are massive, pinkish and friable, and probably corresponds to the *Upper Conglomerate*, 15 ft,
Debris, *Sandstone*, 45 ft.

(8) LOWER CONGLOMERATE, *Debris*; 20 ft.

(7) *Sandstones*, *Shales*, 60 ft.

(6) *Debris*, 10 ft.

(5) LIMONITE; concretionary, honey-combed, 3 ft.

(4) *Shales*, *Sandstones*, *Debris*; with a bench, 85.

(3) *Mountain Limestone*; visible 30 ft.

(2) *Debris*, (*LaGrange Sandstone*); a bench covered with small loose sandstones, 45 ft.

(1) *Mountain Limestone;* fossiliferous, dipping to south-west, to foot of mountain, 60 ft.

6. COAL MEASURES OF FRANKLIN COUNTY.

The Coal Measures of Franklin County cover all of the territory to the south of the bluffy escarpment or mountain in the southern part of the county, though they show as surface rocks only along these escarpments and the creeks to the south of them, being elsewhere hidden by the overlying Drift and Cretaceous strata. Their northern limits, or the mountain, near the eastern edge of the county, is some eleven miles north of the southern boundary of the county, but these limits or this mountain gradually recede towards the south as you go westward until they pass out of the county, on the waters of Bull Mountain Creek, some eight to ten miles east of the western boundary of the county. The escarpment or the mountain also loses its importance towards the west, disappearing or becoming covered up by the Drift and Cretaceous formations except along the water courses, before they get half across the county, though they are some 300 feet high, above the valley to the north of them, in the eastern part of the county. The Coal Measures of this county show to a thickness of about 250 feet and cover about 150 square miles.

DETAILS.

Thin out-crops of coal show in S. 8, T. 7, R. 10 W.; in S.'s 23 and 29, T. 7, R. 11 W., and in S's 7 and 32, T. 8, R. 11 W. The last mentioned of these coal out-crops is in a well and is said to be 18 inches thick.

Coals doubtless crop out in this county on the waters of Big Bear Creek, as they do in Marion County near the county line, as in the following section :

BIG BEAR CREEK SECTION

(7) *Debris*, DRIFT, 60 ft.
(6) SANDSTONE; believed to correspond to the *Upper Conglomerate*, 40 ft.
(5) COAL; thin.
(4) *Shales*, 10 to 15 ft.
(3) COAL, 8 to 20 in.
(2) *Sandstones*, *Shales*, 15 to 20 ft.
(1) CONGLOMERATE; believed to be the *Millstone Grit*, 60 ft.

On Bull Mountain Creek, there are numerous out-crops of two seams of coal from six to nine inches each in thickness, in S's 35 and 36, T. 8, R. 14 W., as in the following section:

BLUE MOUNTAIN CREEK SECTION.

(6) *Debris*, DRIFT, 15 ft.
(5) CONGLOMERATE; believed to be the *Lower Conglomerate*, 40 ft.
(4) COAL, 9 in.
(3) *Clay*; very plastic, visible, 1 ft.
(2) *Debris*, 75 ft.
(1) *Shale*, COAL; the coal is thin streaks in the shale near the bottom, visible, 10 to 15 ft.

In the S. E. ¼ of N. E. ¼ of S. 35, T. 8, R. 14 W., the thin coal streaks of (1) of above section collect together into a seam about six inches thick. The Conglomerate (5) forms a high bluff, that in many places near its base, is covered with a thin skim of limonite, and carries a good deal of limonite in honey-comb masses and in balls. It has also in places large rock-houses with a luxuriant growth of beautiful and rare ferns. The coals of this county are commonly pyritous, and the flagstones often have a good grit for grindstones. The growth over the plateaus consist of chestnuts, chestnut-oaks; white, black, Spanish and post oaks; black-jacks, hickories, black-gums, sweet-gums, persimmons, pines, etc., and, in the bottoms, poplar, linn, black and white walnuts, sour tree, wild cherry, etc.

7. COAL MEASURES OF DeKALB COUNTY.

The Coal Measures of DeKalb County are divided into two parts by Wills Valley, a denuded anticlinal valley. They comprise about 390 square miles to the north-west of that valley, on Raccoon Mountain, and about 100 square miles to the south-east of it on Lookout Mountain. Like the Coal Measures of Madison, Jackson, etc., counties, they are confined to elevated plateaus, on the tops of mountains, bounded by steep mountain sides that are capped with perpendicular bluffs. For a general description of the plateaus and Coal Measures of this county, see *Introduction*. Many of the outcrops of the *Cliff Seam*, and perhaps of the other sub-conglomerate seams, in this county rapidly thicken as drifted into. This is doubtless due to their having been more or less squeezed out or crushed out on the out crops by the ponderous conglomerate bluffs just over them. This thickening would doubtless cease in a short distance from the out-crops or as soon as the crushing or sinking effects of the conglomerate bluffs on the out-crops gave out.

Details.

A. Coal Measures of Raccoon Mountain.—Near the county line in S. 8, T. 10, R. 6 E., there is the following outcrop:

SECTION IN S. 8, T. 10, R. 6 E.

(7) Conglomerate (*Upper*); massive,
(6) COAL, 6 to 8 in.
(5) *Debris*, 25 ft.
(4) *Sandstone*; hard and massive, 15 ft.
(3) *Debris*, 50 ft.
(2) Conglomerate (*Millstone Grit*), 30 ft.
(1) *Debris*.

The strata of the above section are bent over until they dip 75° to 80° to S. E.

On the side of the road as it leads up the mountain in N. W. ¼ of S. 33, T. 9, R. 6 E., there is a showing of coal smut from six to eight inches thick. It is over the Lower Conglomerate and is most probably of the same seam as (6) of the last section. Along with this coal smut, there is an out-crop of plastic clay, of a light ash color, about ten feet thick. Thirty to forty feet higher is another out-crop of a similar clay. These clays are now being made into jugs on the mountain and answer very well for this purpose.

The Millstone Grit or Cliff Rock on the side of the mountain in the N. W. ¼ of N. W. ¼ of S. 24, T. 9, R. 6 E., has a dip of about 75° to N. W. and in the S. E. corner of S. 6, T. 9, R. 7 E., and the N. E. ¼ of S. 32, T. 8, R. 7 E., there are large detached boulders of it, house-size in dimensions, on the side of the mountain and in the narrow *Sand Valley* at its foot. The Millstone Grit is here some 75 feet thick and dips about 30° to N. W. The *Cliff Seam* of coal shows under it, in some places a few inches thick.

The most south-western Mountain Limestone seen in DeKalb county on this, the N. W. side of Wills' Valley, is along the foot of the mountain in the S. E. ¼ of S. 29, T. 8, R. 7 E. It extends about one-fourth the way up the mountain, and shows to the north-east for about one-fourth mile before giving out to set in again. In the road up the mountain at Winston Gap, in the N. E. ¼ of S. 36, T. 7, R. 7 E., about 50 feet from the top of the mountain, there is an out-crop of coal with fire clay. Below this coal out-crop, there is considerable limonite on the side of the mountain. The Coal Measures along the above road are believed to be partly in a slide. In another gap about, one mile farther to the north-east, the strata have a dip of about 25° to N. W. The Mountain Limestone shows in between these gaps. The *Cliff Seam* of coal is said to crop out in the N. E. ¼ of S. 19, T. 7, R. 8 E., and to be sixteen inches thick. On the side of the mountain under it, there is considerable limonite.

On top of the mountain at Mr. John W. Neal's, in the S. ½ of N. E. ¼ of S. 8, T. 7, R. 8 E., there occurs the following section:

THE NEAL SECTION,
IN S. ½ OF N. E. ¼ OF S. 8, T. 7, R. 8 E.

(4) *Shale;* hard, visible about 6 ft.
(3) COAL; about 10 in.
(2) *Clay;* parting 4 to 6 in.
(1) COAL 8 to 10 in.

This coal is most probably of the *Sewanee Seam* or (6) of the *Etna Section.*

On the side of the mountain opposite, or to the south-east of Mr John W. Neal's and for several miles to the north-east are reported out-croppings of the *Cliff Seam*, (5) *of the Etna Section*, from 8 to 15 inches in thickness.

In the road up the mountain at the Gibson Gap, in the N. W. ¼ of S. 25, T. 6, R., 8 E., are the out-croppings of two sets of conglomerates that are separated by from 25 to 30 feet of flagstones. In these flagstones, there are several chalybeate springs which probably have their origin in thin seams of coal. In the bluffs of the lower of these conglomerates, there are some strongly warped or bent flagstones.

Still farther to the north-east in the N. W. ¼ of S. 19, and S. E. ¼ of S. 18, T. 6, R. 9 E, the *Cliff Seam* is only about six inches thick on the out-crop. The strata of the conglomerate bluff (*Cliff Rock*) show here plainly that they are in long flat waves from north-east to south-west.

On top of the mountain in S's 15, 27 & 28, T. 6, R. 8, E., there are out-crops of coal from 4 to 14 inches in thickness. These out-crops are of what is called the surface seam, which is most probably the same as the *Sewanee Seam*, (6) of the Etna Section.

On a branch in S. 23, T. 6, R. 8 E., there is the following section:

SECTION IN S. 23, T. 6, R. 8 E.

(4) *Conglomerate* (Upper)
(3) *Debris;* about 15 ft.
(2) *Shale*; visible 5 ft.
(1) COAL, 1 ft. 2 in.

The dip is here about 10° to N. W. though the strata are in waves from N. W. to S. E.

About one-fourth mile to the south-west is another test pit in which the coal is reported to be about 12 inches thick and to overlie about 4 inches in thickness of *mother of coal.* The coals of these two pits are also most probably of the *Sewanee Seam*, (6) of the Etna Section.

Under the *Lower Conglomerate* or *Cliff Rock* bluff in the S. E. ¼ of S. 24, T. 6, R. 8 E., is a *rock-house* that has been converted into a milk-house by the building of a wall across its mouth. A short distance to the north-east, this bluff is some 80 feet high and the *Cliff Seam* of coal under it is on the out crop from 4 to 12 inches in thickness.

Some half-mile still farther to the north east in the N. W. ¼ of S. 19, T. 6, R. 9 E, the *Cliff Seam* has been drifted into for about 15 feet. At the head of this drift there is the following section:

SECTION IN N. W. ¼ OF S. 19, T. 6, R. 9 E.

(6) *Conglomerate* (*Lower*); bluff, 50 ft.
(5) COAL, 1 ft.
(4) *Fire Clay* 4 ft.
(3) *Shale*, 3 ft.
(2) COAL; reported, 1 ft. 8 in.
(1) *Fire Clay.*

On the out-crop, the coals (2) and (5) of this section are from 12 to 14 feet apart. They were therefore rapidly approaching each other as drifted into. The coming together of these two coals is in the thinning out of the shale (3) and the rising correspondingly of the under coal (2). The conglomerate bluff is here uniformly full of pebbles from the bottom to the top. The dip is about 20° to N. W. Some 150 yards to the north-east, the coal just under the conglomerate bluff, or (5) of the above section is from 8 to 12 inches thick, and has in it streaks of pyrites. Here the fire-clay underbed, (4) of the above section, is about 4 feet 6 inches thick. The coal (2) is not exposed and so I can't say anything as to its thickness or the thickness of the

shale (3). There are here no pebbles in the lower part of the conglomerate bluff and the dip is from 20° to 25° to N. W.

Farther to the north-east, in the southern part of S. 18, T. 6, R. 9 E. the *Cliff Seam* of coal on the out-crop is only about 12 inches thick, though about 4 feet under the bluff it is some 26 inches thick.

To the north-west of here from 3 to 3½ miles, to the north-west of Town Creek, there are reported to be several out-crops of coal from 8 to 18 inches in thickness. They are said to have a gray slate cover and a fire-clay underbed. They are most probably of the *Sewanee Seam*, (6) of the Etna Section, though they may be of the *Kelly Seam*, (8) of the Etna Section.

On the top of the mountain and seemingly just over the Lower Conglomerate, in a glady place in the S. E. corner of S. 7, T. 6, R. 9 E., is an out-cropping of a seam of sandy brown ore about 18 inches thick. It is full of little holes and has an argillaceous look.

In the S. W. ¼ of N. W. ¼ of S. 17, T. 6, R. 9 E., is a pinnacle or columnar rock of the height of the bluff of Lower Conglomerate from which it is separated at the base by only five to 6 feet and the top by about 15 feet. In diameter, its base is about 25 feet, its capping rock about 20 feet, and its neck, just under the capping rock, some 15 feet. Its height is about 60 feet and as it is but a part, detached by denudation, of the adjacent bluff, and is of course of the same material as this bluff or as the Lower Conglomerate or Millstone Grit.

Just to the north-east of the above *pinnacle rock* the *Cliff Seam* of coal has been drifted into for 15 to 20 feet. At the head of this drift, there is about the following section :

SECTION IN THE S. W. ¼ OF N. W. ¼ OF S 17, T. 6, R. 9 E.

(9) CONGLOMERATE (*Lower*); bluff, about 60 ft.
(8) COAL, 6 to 8 in.
(7) *Slate*; parting, 1½ in.
(6) COAL, 2 in.
(5) *Slate*, 1½ in.
(4) COAL, 2½ to 3 in.
(3) *Slate*, 1½ in.
(2) COAL, 1 in.
(1) *Fire Clay;* underbed.

In this drift the coal seam varies more or less in thickness from the coming in, in places, between it and the conglomerate of seams of shale. The strata are in long flat waves from N.. E. to S. W., and the dip is from 30° to 35° to the N. W.

For some three-fourths of a mile to the north-east, the above seam of coal, the *Cliff Seam*, has been dug or drifted into in three places and in these drifts it is said to vary from 16 inches to 3 feet in thickness. Near the center of S. 8, T. 6, R. 9 E., it is about 14 inches thick on the out-crop, but about 10 feet under the conglomerate bluff it gets to be some 42 inches thick. Of this 42 inches, the lower 15 inches are divided up by irregular streaks of slate, the uppermost 6 to 8 inches are a cubical coal, and the remaining central portion is a very soft and a very rich or very bituminous, leaf-like coal. This leaf-like coal is of very fine quality and will doubtless make the best of coke. The underbed is a fire clay and the cover is the conglomerate bluff some 50 feet in height. This bluff is made up of two massive strata that are separated by only a few inches of shaly or flaggy material. The lower stratum is about 15 feet in thickness and in places is destitute of pebbles, and in places its lower 3 to 4 feet are more or less flaggy, and sometimes false-bedded. The strata are in waves from N. E. to S. W., and the dip is some 30° to 35° to the N. W.

In the above seam of coal, the *Cliff Seam*, there is in the north-east corner of S. 8, T. 6, R. 9 E., a drift some 8 feet

wide that extends under the conglomerate bluff about 12 feet. At the back or head of this drift in the north-east corner, there is something like the following section:

SECTION IN N. E. CORNER OF S. 8, T. 6, R. 9, E.

(11) CONGLOMERATE, (*Lower*); bluff, about 50 ft.
(10) COAL, 6 in.
(9) *Shale*, 1½ in.
(8) COAL, 8 in.
(7) *Shale*, 1 in.
(6) COAL, 4 in.
(5) *Shale*, 1 in.
(4) COAL, 8 in.
(3) *Shale;* clayey, 1 in.
(2) COAL, 6 in.
(1) *Fire Clay;* underbed, visible 3 ft. 0 in.

In the north-west corner of the back or head of this drift, the coal seam is said to be 43 inches thick. In this drift the coal is jam up against the massive conglomerate cover. This conglomerate at the bottom, however, has no pebbles in it, and in places passes into flags showing false-bedded. The strata are in waves from N. E. to S. W., and the dip is about 30° to the N. W.

In the road up the mountain at the Smith Gap, in the N. E. ¼ of S. E. ¼ of S. 5, T. 6, R. 9 E., there is the following out-crop.

OUT-CROP AT THE SMITH GAP IN THE N. E. ¼ OF S, E. ¼ OF S. 5, T. 6, R. 9 E.

(7) CONGLOMERATE (*Lower*); bluff.
(6) *Flagstones*, 4 to 5 ft.
(5) *Iron Ore*, 3 to 6 ft.
(4) *Flagstone;* 0 to 3 ft.
(3) COAL; good, 1 ft.
(2) COAL; slaty, 6 in.
(1) *Fire Clay*.

In the strata between the coal (3) and the conglomerate (7) there are some nodules of clay iron-stone and iron-stone pyrites. The upper part of the conglomerate along the crest of

the mountain has a dip of about 50° to the N. W., though, in going to the N. W., they soon flatten to a dip of not over 15° to N. W.

In an old road in the N. E. ¼ of S. 5, T. 6, R. 9 E., there is the following out-crop.

OUT-CROP IN N. E. ¼ OF S. 5, T. 6, R. 9 E.

(4) *Sandstones;* massive.

(3) *Debris;* about 15 ft.

(2) *Sandstones, Debris*; the sandstones are flaggy, 4 to 5 ft.

(1) COAL; smut, 4 to 6 in.

This coal smut is probably of (10) of the Etna Section.

Along Town Creek, in the N. E. ¼ of S. 5, T. 6, R. 9 E., the Upper Conglomerate, (7½) of the Etna Section, shows that it is in waves from N. W. to S. E.

In W. J. Hamman's field in the eastern part of the S. E. ¼ of S. 32, T. 5, R. 9 E., there is a reported out-cropping of coal about 20 inches thick. This out-cropping is probably of (9) of the Etna Section, as is most probably the coal smut, about 12 inches thick, that shows in a road in the S. W. ¼ of N. W. ¼ of S. 33, T. 5, R. 9 E. The Kelly Seam, (8) of the Etna Section, is here probably entirely wanting. The *Upper Conglomerate* here crops out along the west bank of Town Creek, and the *Lower Conglomerate* forms the slanting surface from the creek to the crest of the mountain on the south-east side.

On the side of the mountain at *Mr. John Shankles' mine*, in the S. W. corner of S. E. ¼ of S. 33, T. 5, R. 9 E., there is the following section:

SECTION AT MR. JOHN SHANKLES' MINE, IN THE S. W. CORNER OF S. E. ¼ OF S. 33, T. 5, R. 9 E.

(8) CONGLOMERATE (*Lower*); bluff, 30 to 40 ft.

(7) COAL; in thin seams in the rocks, 0 to 4 in.

(6) *Sandstone;* very hard, 6 to 12 in

(5) COAL; with irregular streaks and spots of bituminous sandstone and shale, 8 to 18 in.

(4) *Shale*, 1 ft. 4 in.

(3) COAL; streak.

(2) *Fire Clay;* visible, 3 ft.

(1) *Debris.*

The conglomerate (8) is here full of pebbles. The dip is from 15° to 20° to N. W.

At the mouth of an old drift on the side of the mountain, in an out-crop of the *Cliff Seam* of coal, in N. W. ¼ of N. W. ¼ of S. 13, T. 5, R. 9 E., there is the following section:

SECTION IN N. W. ¼ OF N. W. ¼ OF S. 13, T. 5, R. 9 E.

(9) CONGLOMERATE (*Millstone Grit*), 15 ft.
(8) *Debris*; probably principally shale, 50 ft.
(7) *Shale*; cover to drift.
(6) COAL, 9 in.
(5) *Shale*, COAL; coal in thin streaks in shale, 1½ in.
(4) COAL, 2 in.
(3) *Shale*, COAL; shale clayey and coal in thin streaks in shale, 3½ in.
(2) COAL, 4½ in.
(1) *Clay*; visible, 6 in.

This coal is said to have gotten better as gone into.

To the north-east of this point, the edge of this mountain is high and bluffy though not so high, by from 200 to 300 feet as Lookout Mountain just across the narrow valley. To the north east of here the two conglomerates form, on all the prominent points, each a row of bluffs.

Along the road up the mountain near Sulphur Springs, at Brown's Gap in S. E. ¼ of S. 9, T. 4, R. 10 E., there shows the following section:

BROWN'S GAP SECTION.

(4) CONGLOMERATE (*Upper*), 75 to 80 ft.
(3) *Debris*, 20 ft.
(2) COAL SMUT; thin.
(1) *Debris*; loose conglomerates and sandstones with some bedded shales and clays, believed to hide the LOWER CONGLOMERATE, to bench, 300 to 325 ft.
Mountain Limestone; about, 375 ft.

Between the above gap and the Georgia line, the coal under the Lower Conglomerate, the *Cliff Seam*, is said by some to show three feet in thickness, but to carry partings of slate. By others, the coal of this neighborhood is said to

bo only from 12 to 14 inches in thickness. The S. E. crest of the mountain to the north-east of Brown's Gap is of the Upper Conglomerate, which is here very massive and is frequently nothing more than a mass of pebbles. It forms in places great naked or glady spots and is in waves from north-west to south-east. The mountain here, over large areas, is hollow as can readily be told by the resounding sound in walking over it. On top of the mountain in the N. E. ¼ of S. E. ¼ of S. 32, T. 3, R. 10 E., there is an out-crop of coal with fire-clay, which is believed to be over the Upper Conglomerate.

Fox Mountain, principally in Georgia, is an offshoot of Raccoon Mountain, with "Deer Head Cove" between them. The Coal Measures of this mountain are not connected with those of Raccoon Mountain, the surface rocks of the narrow gap or connecting link between them being of the uppermost Mountain Limestones. Fox Mountain is surrounded almost entirely, if not entirely, by two lines of bluffs formed by the Upper and Lower Conglomerates. These bluffs plainly show at a distance that their strata are in long waves from north-east to south-west, as well as from north-west to south-east. The top of the mountain is of the trough of one of the great waves from north-west to south-east. Under the lower line of bluffs or the Millstone Grit of this mountain, there are said to be out-crops of coal (the *Cliff Seam*) from 8 to 12 inches thick. The cedars appear to extend about one-third of the way up the mountain.

B. COAL MEASURES OF LOOKOUT MOUNTAIN—On this mountain, from Little Wills Valley, the Lower and Upper Conglomerates are seen forming on all the prominent points each a line of bluffs. The bluffs of the lower line or of the Lower Conglomerate are usually much the higher. Between the prominent points, the Upper Conglomerate usually crops back on the mountain and does not show from the valley. These lines of bluffs as well as thin strata are in long flat waves from N. E. to S. W. Their strata slope away from the edge of the mountain, or to the south-east, and as the dip along the south-east edge of the mountain is also away from the

edge of the mountain, or to the north-west and somewhat steeper, the edges of the mountain are its most elevated portions and head. The mountain is an irregular synclinal trough.

The structure of this mountain can be seen from an inspection of Section I, though in places to the north-east and south-west of the line of the above section the super-conglomerate measures are much thicker, and include several thin seams of coal. The following is a general section of the thicker measures of Lookout Mountain:

GENERAL SECTION OF THE THICKER COAL MEASURES OF LOOKOUT MOUNTAIN.

Sandstones; often shaly and slabby, 0 to 75 ft.
(8) COAL, 4 in. to 2 ft.
Shales, 4 to 10 ft.
(7) COAL, 0 to 0 ft. 10 in.
Shale, 25 to 30 ft.
(6) COAL, 3 in. to 1 ft 8 in.
UPPER CONGLOMERATE, 50 to 60 ft.
(5) COAL, 0 to 1 ft.
Shales, 0 to 9 ft.
(4) COAL (Sewanee in Fort Payne Mines) from 2 ft. to 3 ft. 6 in.
Shales, Sandstones, 35 ft. to 40 ft.
LOWER CONGLOMERATE, 25 ft. to 100 ft.
(3) COAL, 0 to 2 ft.
Sandstones, *Shales*, 40 to 50 ft.
(2) COAL (Dade, Eureka), 1 ft. 6 in. to 2 ft. 8 in.
Fire Clay; full of fossil stems, 3 ft. to 20 ft.
(1) COAL, 6 in. to 1 ft. 6 in.
Sandstones, *Shales*; about 250 ft.
MOUNTAIN LIMESTONE.

At the Eureka Old Mines, there is something like the following out-crop:

EUREKA OUT-CROP.

(6) CONGLOMERATE (*Upper*); forming a bluff some 250 yds. back from top of mountain, 20 ft.
(5) *Debris*, (most probably covers coal) 60 to 70 ft.
(4) CONGLOMERATE (*Cliff Rock*); 40 to 50 ft.
(3) *Debris*, (most probably covers coal) 40 to 45 ft.
(2) COAL (*Dade Seam*); said to be from 1 to 7 ft.
(1) *Debris*; perhaps a coal seam in upper part, to foot of mountain. 800 ft.

The coal (2) was hid at the time visited, though it is said to be very variable in thickness and to have a slate parting near its centre. These mines consisted of two drifts about 150 yards apart. The mouth of the more north-eastern drift is some ten feet the lower and the mines are drained through. it. The coal was let down the mountain by a drum and incline. The Upper Conglomerate is here full of pebbles and dips 10° to 15° to S. E. The edge of the mountain from here on to Valley Head is very high and shows most of the way, from the valley, two lines of bluffs.

On the brink of the mountain near the center of the S. E. ¼ of S. 21, T. 5, R. 10 E., is the *tripod rock.* This rock is some 15 feet higher than the mountain, and stands on three legs, hence its name. The legs are however only a few feet in length. It stands right on the brink of the mountain, which is here more than 800 feet higher than Valley Head in the valley below. The rock on top is some 8x12 feet broad, and from its top the view up and down the valley is grand. Fort Payne, 12 miles down the valley, can easily be seen with the naked eye. On top it is worn into pot-holes. It is of the Lower Conglomerate or Millstone Grit and shows finely the effects of weathering.

On the side of the mountain a short distance to the south-west of the *tripod rock*, and just to the north-east of *Mentone*, on the brink of the mountain in the N. W. ¼ of N. E ¼, of S. 28, T. 5, R. 10 E., are two test pits dug into the *Dade or Eureka seam* of coal, (4) of the Etna Section. At these pits there is the following section:

MENTONE SECTION IN
N. W. ¼ OF N. E. ¼ OF S. 28, T. 5, R. 10 E.

(10) CONGLOMERATE (LOWER).
(9) *Debris*, 15 to 20 ft.
(8) *Shale;* visible, about 12 ft.
(7) COAL, 10 in.
(6) *Shale*, 2 in.
(5) COAL; shaly, 4 to 5 in.
(4) COAL, 1 ft. 2 in. to 1 ft. 3 in.
(3) *Clayey Shale*, 6 in.
(2) COAL; streak.
(1) *Fire Clay*; underbed.

Lower down the mountain, 25 to 30 feet under the outcrop of the above seam of coal is a fine chalybeate spring.

From Mentone there is a gradual slant in the surface to the south-east to the West Fork of Little River about one mile distant. The Lower Conglomerate even does not set in here for several hundred yards to the south-east of the brink of the mountain, and the Upper Conglomerate does not make its appearance for some three miles to the south-east or until a point about half-way between the West Fork and East Fork of Little River is reached.

From just under the Upper Conglomerate on Brush Creek in the S. W. corner of S. 1, T. 6, R. 10 E., there is an out-crop of a seam of coal which is most probably identical with the Sewanee Seam, or (6) of the Etna Section.

At this out-crop there is about the following section :

SECTION ON BRUSH CREEK IN S. W. CORNER OF S. 1, T. 6. R. 10 E.

(6) CONGLOMERATE (UPPER).
(5) *Shale*, 0 to 3 ft.
(4) COAL, 8 in.
(3) *Clayey Shale*, 1 in.
(2) COAL, 11 in.
(1) *Fire Clay*; underbed.

The dip is about 10° to S. E.

Only a few feet to the south of the out-crop of this section, just across Brush Creek from it, an out-crop of coal is said to have been dug down into to a depth of four feet without getting through it. These out-crops are of the same seam of coal and the seemingly much greater thickness of latter is probably due to a folding or doubling of the strata.

In the S. W. ¼ of S. 31, T. 5, R. 11 E., there is a reported out-crop of coal from 14 to 15 inches in thickness. It is doubtless of the same seam as the coal of the last section, or (6) of the Etna Section, as are most probably the coals out-cropping under the bluff along the East Fork of Little River in S's 23, 27, & 34, T. 6, R. 10 E., which are reported to be from 10 to 16 inches in thickness.

On the brink of the mountain about one-half mile to the south-west of Mentone, there is the following out-crop of the Eureka or Dade seam of coal, (4) of the Etna Section.

SECTION ONE-HALF MILE SOUTH-WEST OF MENTONE.

(8) CONGLOMERATE (LOWER).
(7) *Debris*; perhaps, 10 to 15 ft.
(6) *Flagstones*; visible, 6 to 8 ft.
(5) Shale, 10 ft.
(4) COAL, about, 10 in.
(3) *Shale*; parting 1½ in.
(2) COAL; with a thin slaty parting near the center, about 2 ft.
(1) *Fire Clay*; underbed, visible 3 ft,

The Lower Conglomerate here sets in several hundred yards to the south-east of the brink of the mountain. The dip of the above coal is about 10° to S. E.

The *Upper Falls* of Little River are on the West Fork in the N. E. ¼ of N. E. ¼ of S. 4, T. 6, R. 10 E. They are made up of first, a fall of about 10 ft. into a small shallow pool, that is said to have been formed or washed out within the last 30 years, and then a steep cascade from 25 to 30 feet to the big perpendicular fall of about 50 feet. The upper strata of these falls are of the Lower Conglomerate. The bluffs on either side of the river just below these falls are from 75 to 80 feet in height. These bluffs extend down the river about one mile, though the bluff on the south-east side leaves the river in about one-fourth mile below the falls, and there are then along the river on this south-east side some good bottom lands. Some four miles below the *Upper Falls* there is said to be on the West Fork a small fall of from 6 to 8 feet.

On the edge of the mountain opposite Price's Switch or Cordell's P. O., four miles south-west of Valley Head, there is no appearance of either conglomerate, though the Coal Measures are some 200 feet thick. The Lower Conglomerate occurs here either as a sandstone, or back from the brink of the mountain some 65 to 70 feet from the top of the mountain, is a strong chalybeate spring which probably has its origin in a coal seam, and some 15 feet lower is a very

black shale that has been dug into for coal, perhaps of the horison of the *Dade or Eureka Seam.*

Opposite the water tank, on the side of the mountain near the center of the N. E. ¼ of S. 34, T. 6, R. 9 E., there is an old coal mine or drift. At this drift, the mountain shows about the following section:

SECTION IN N. E. ¼ OF S. 34, T. 6, R. 9 E.

(12) CONGLOMERATE (*Upper*), 25 ft.
(11) *Debris*, 16 ft.
(10) *Sandstone*; massive, doubtless the *Cliff Rock*, 15 to 20 ft.
(9) *Shale*, 40 ft.
(8) COAL (*Dade or Eureka Seam*), 2 ft. 6 in.
(7) *Shale*; with kidney ore just under coal, 110 ft.
(6) *Flagstones*, 25 ft.
(5) *Shale*, 25 ft.
(4) *Debris*; with some bedded shales, 200 ft.
(3) *Limestone*; visible, 15 ft.
(2) *Debris* (LaGrange Sandstone, etc.,) 90 to 100 ft.
(1) *Debris*; Mountain Limestone, to foot of mountain, 125 ft.

The above coal (4) on the out-crop was about 2 ft. thick, but within a few feet thickened to 2 feet 6 inches.

Nearly two miles to the south-west, at the Beeson Gap in the S. W. ¼ of N. W. ¼ of S. 3, T. 7, R. 9 E., there occurs something like the following section:

BEESON GAP SECTION, IN S. W. ¼ OF N. W. ¼ OF S. 3, R. 9 E.

(12) CONGLOMERATE (UPPER).
(11) *Debris*; hiding one or more seams of coal, about 60 ft.
(10) CONGLOMERATE (LOWER); about 25 ft.
(9) COAL; streak.
(8) *Sandstone*; bluish and hard, 25 ft.
(7) *Debris*; about 25 ft.
(6) *Sandstone*; about 4 ft.
(5) COAL; on out-crop, 2 ft. 2 in.
(4) COAL; slaty, 4 in.
(3) *Fire Clay*; full of fossil impressions, 3 to 14 ft.
(2) COAL; reported, 6 in. to 1 ft. 6 in.
(1) *Debris*.

The coal streak (9) of the above section is exposed in the deep railroad cut, on the brow of the mountain, in a hard

spongy ferruginous conglomerate streak that is from 0 to 12 inches thick. This coal thickens out into a seam, which was struck at the bottom of a well not over 75 yards to the north-east of the exposure in the cut. The coal (5) has been drifted into for something over 100 yards. On the out-crop, it is about 20 feet over the coal (2) but it is said to approach or dip to (2) until in 100 yards within they are not over 3 feet apart. The clay (3) is being mined here and used in the pottery and fire clay works at Fort Payne. It is very hard and mines in large lumps, but on weathering it crumbles and becomes very plastic on wetting. As a matrix for siliceous material, it makes a very good fire brick. It is full of fossil stem and leaf impressions. The Debris (11) of the above section hides one or two seams of coal as they are seen occupying that position within two miles of this locality, The *Upper Conglomerate*, (12) of the above section, sets in some 200 yards to the south-east of the brow of the mountain; it is very massive and full of pebbles and forms glady places that are sometimes naked and are sometimes covered with a luxuriant growth of grasses. The *Lower Conglomerate*, (10) of the above section is here comparatively thin but in a short distance to the south-east, it becomes very thick and massive. In places it is nothing more than a white quartzose sandstone. The sandstone (8) of the above section is also like a white quartzite in places. The Lower Conglomerate on the brow of the mountain at the above gap is about level, but in about 100 yards to the south-east it curves to a dip of some 30° to the south-east. The dip down on the N. W. side of the mountain is 10° to 15° to S. E. The surface, in a general way, slopes from near the gap some four miles to the south-east to where the strata, occupying the lowest part of the trough of the basin, are about flat.

The coal mines of the Fort Payne Coal and Iron Company, in the N. E. ¼ of S. 23, T. 7, R. 9 E., consisted at the time visited, in July 1890, of five drifts. At these drifts there is something like the following section:

SECTION AT THE FORT PAYNE C. & I. CO. MINES, IN THE S. E. ¼ OF N. E. ¼ OF S. 23, T. 9, R. 9 E.

(6) CONGLOMERATE (UPPER).
(5) *Shale* 0 to 6 ft.
(4) COAL 0 to 1 ft.
(3) *Shale* 0 to 9 ft.
(2) COAL 2 ft. to 3 ft. 6 in.
(1) *Fire Clay.*

The coal (2) of this section is the *Sewanee Seam*, (6) of the Etna Section. In the above drifts, it is in waves from N. W. to S. E. The thicker portions of it are in the troughs or *marshes* of these waves. The thickening and thinning in the seam take place mostly in the top of the seam though some changes do occur in the bottom. It has in it, most commonly near the bottom, some thin irregular seams of slate. It is in places jam up against the Conglomerate (Upper) while in other places it is separated from the Conglomerate by as much as 15 feet of shale with a seam of coal that varies from 0 to 12 inches in thickness. The fire clay underbed, (1) of the above section, appears in places to change to a hard clayey looking sandstone that is full of fossil stem and leaf impressions and has no cleavage planes.

Nearly one mile to the east of the above mines, or in the S. E. corner of S. W. ¼ of N. E. ¼ of S. 24, T. 7, R. 9 E., is the *Lowery Coal Bank*. At this bank there is a drift into the following seam of coal:

OUT-CROP AT THE LOWERY COAL BANK, IN THE S. E. CORNER OF S. W. ¼ OF N. E. ¼ S. 24, T.7, R. 9 E.

(4) CONGLOMERATE (UPPER).
(3) *Sandstone*, in ledges, 6 to 8 ft.
(2) COAL; with thin slate partings, 1 ft. 7 in.
(1) *Fire Clay*; visible 4 ft.

Within the drift, the coal (2) is said to be 2 feet 2 inches thick. This coal is of the same seam as the coal of the Fort Payne C. & I. CO. Mines, but the thin coal seam that is in

places between that coal and the Upper Conglomerate does not occur here. The dip here is about 10° to S. E.

This same seam of coal is reported to crop out in the N. E. ¼ of N. E. ¼ of S. 24, T. 7, R. 9 E. Some 40 feet above it, in the shale over the Upper Conglomerate, is a thin seam of coal, as shown by out crops in several places. Some 40 to 45 feet higher is another seam of coal which, in the out-crop near Mr. Geo. Baker's, in the S. W. ¼ of S. 7, T. 7, R. 10 E., is only 6 inches thick, though at the back of the drift, driven in on this out-cropping about 10 feet, the coal is from 12 to 15 inches thick. This coal out-crop is under a bluff of sandstone that is massive in the upper part and flaggy near the bottom. The underbed is a bluish fire clay that is visible to a thickness of about 3 feet.

The Lower Conglomerate forms the bed of the river in S's 16, 17 & 20, T. 7, R. 10 E., and out in the hills, some 60 feet above the bed of the river, are out-crops from 8 to 12 inches in thickness of the coal seam under the Upper Conglomerate, the Sewanee Seam or (6) of the Etna Section.

The Lower Conglomerate on Yellow Creek about ½ mile above its mouth or in the N. W. ¼ of S. 30, T. 7, R. 10 E., shows a thickness of some 50 feet. It is here very massive and forms a bluff along the creek and a fall in the creek of 15 to 20 feet. The Conglomerate here at this fall appears to be almost level. Just under this Conglomerate, or in its bottom strata, is a very irregular seam of coal, the *Cliff Seam*, (5) of the Etna Section. This seam of coal crops out about low water level on the west bank of Little River just above the ford in the southern part of the N. E. ¼ of S. 30, T. 7, R. 10 E., and also just below the mouth of Yellow Creek, or above "The Falls," in the eastern part of the S. W. ¼ of S. 30, T. 7, R. 10 E. It is a very irregular seam; in places it is nothing more than the irregular streaks of coal through a very hard conglomerate and in other places it bulges out into pockets of coal of as much as two feet in thickness. The coal of these pockets is as a general thing very hard and of very fine quality. This irregular seam of coal also shows in the east bank of the river just below "*The Falls*," and about even

with the top of "*The Falls*." This last out-crop is, however, in Cherokee county, as the river is here the county line.

"*The Falls*" are therefore over strata that are just under the Cliff Seam of coal or just under the Lower Conglomerate. "*The Falls*" are about 40 feet in perpendicular height, and the strata, with the exception of the lower four to five feet, are of sandstones. The upper of these sandstones is massive while the lower ones are slabby and are false bedded. Just under these slabby sandstones, or some 35 feet under the Cliff Seam, and some four feet above the pool just below "*The Falls*," is a seam of coal with a hard fire clay underbed. This seam of coal at "*The Falls*," is from 8 to 14 inches in thickness, though, in the gorge of the river several miles below, it is nearly 2 feet in thickness. The fire clay underbed is very hard and is very full of fossil leaf and stem impressions. This seam of coal corresponds, it is believed, to the Dade or Eureka Seam, (4) of the Etna Section. The strata in the bluffs just below "*The Falls*" are in waves from north-east to south-west.

Opposite Fort Payne, or on the side of the mountain just to the south east of the city, the sub-conglomerate measures appear to be about 300 feet in thickness. The two conglomerates here, along the road, are back respectively about one-fourth and one-half mile from the brow of the mountain.

On the side of the mountain about opposite to or above *Manitou Cave*, in the S. W. ¼ of S. 17, T. 7, R. 9 E., there is reported to be the following section:

SECTION IN S. W. ¼ OF S. 17, T. 7, R. 9 E.

(6) *Bluff* (most probably the *Lower Conglomerate*).
(5) *Debris, Shales*; about 25 ft.
(4) COAL, 1 ft. 3 in.
(3) *Fire Clay*, 2 ft.
(2) COAL, 1 ft. 5 in.
(1) *Fire Clay*.

These coals are probably of the Dade or Eureka Seam, (4) of the Etna Section, and, as at Beeson Gap some 3 miles to the north-east, would probably come close together on being drifted into.

On the side of the hill in the N. E. ¼ of S. W. ¼ of S. 2, T. 9, R. 8 E., is an out-crop of coal that appears to be 8 inches thick, and in the S. ½ of N. E. ¼ of S. 3, T. 9, R. 8 E., there is a coal out-crop that is reported to be 14 inches thick.

In the S. E. ¼ of S. 2, T. 9, R. 8 E., the strata are in waves from N. W. to S. E. In S's 3 & 10, T. 9, R. 8 E., the Upper Conglomerate on the divides between the creeks and branches form many glady places and are often naked. A seam of coal about 6 inches thick is said to have been dug into in the S. E. ¼ of S. E. ¼ of S. 20, T. 9, R. 8 E.

A great deal of coal has been raised by "surface-digging" from the out-croppings of a seam about 18 inches thick along a branch in the S. W. ¼ of S. W. ¼ of S. 1, T. 10, R. 7 E. In one of the pits, the coal is said to have been 27 inches thick. This coal is probably (8) of the Etna Section. A few feet under it are some massive sandstones, and 8 to 10 feet above it there is reported to be a seam of coal about 4 inches thick.

In the N. W. ¼ of S. 1, T. 10, R. 7 E., are some coal diggings into a seam that is said to be from 9 to 12 inches thick. This coal is most probably of the same seam as that of the last mentioned diggings.

8. COAL MEASURES OF CHEROKEE COUNTY.

The Coal Measures of Cherokee county are all of an elevated plateau. They are of one body, and are confined to the top of Lookout Mountain. They comprise some 150 square miles, and from the south-east half of the shallow tray slope depression or cynclinal trough that makes the top of Lookout Mountain. The north-western boundary of these measures is in great part formed by the East Fork of Little River which is also the county line; while their south-eastern boundary is just under or to the south-east of the south-east brow of the mountain. They are of course most elevated along the south-east brow of the mountain which is from 400 to 700 feet above Little River and from 900 to 1100 feet above the Coosa River. The dip of the strata, with the exception of that due to waves, is all to the north-west. It is greatest along the south-east edge of the measures where it is often quite steep, and gradually gets less to the north-west until finally along the county line on the north-west, near the center of the synclinal trough, the strata are about level.

Great natural exposures and sections of almost the full thickness of the Coal Measures of this county are to be seen in the deep ditch-like gulches and high perpendicular falls along Little River and Yellow Creek. For a general description of these exposures and of the Coal Measures of this county, see that of the Plateau Region in the *Introduction.*

DETAILS.

Near the State line in this county, the Coal Measures appear to be about 300 feet thick and to include from four to five thin seams of coal. At least one-half of this

thickness, with two of the coal seams, is of the sub-conglomerate measures. The coal out-crops on the mountain are usually from 6 to 8 inches in thickness, though, under a bluff along the river in S's 23, 27, & 34, T. 6, R. 10 E., there are out-crops of a seam of coal that is reported to be from 14 to 16 inches in thickness. This coal seam most probably corresponds to she *Sewanee Seam*, (6) of the *Etna Section*.

In places, there are out-crops of beautiful flagstones that are well suited for paving, etc.

The Lower Conglomerate forms the bed of the river in S's 16, 17 & 20, T. 7. R. 10 E., and 60 to 70 feet above the river are out-croppings of the Upper Conglomerate with a seam of coal under it.

Near the school-house in the S. E. ¼ of N. W. ¼ of S. 21, T. 7, R. 10 E., there is something like the following out-crop:

OUT-CROP IN S. E. ¼ OF N. W. ¼ OF S. 21, T. 7, R. 10 E.

(6) CONGLOMERATE, (UPPER).
(5) *Sandstone*, COAL; the coal in streaks in the sandstone, 2 ft.
(4) *Shale;* very hard 5 ft.
(3) COAL, 8 to 10 inches.
(2) *Debris*, 15 to 20 ft.
(1) COAL; reported 1 ft. 8 in.

The dip is 10° to 15° to N. W. These coals, (1) and (3), correspond to (6) and (7) of the Etna Section.

About ¼ mile to the S. E. S., is the *Bowman coal bed.* At this bed the coal is from 8 to 12 inches thick. It is just under the Upper Conglomerate and has an underbed of fire clay. The dip here is also 10° to 15° to N. W. This coal is doubtless of the same seam as the upper coal of the last section.

Down on the side of the mountain in the S. E. ¼ of S. 28, T. 7, R. 10 E., is the Widow Kennedy coal bed. It is reported to be 20 inches thick. It is under the Lower Conglomerate and is probably the Eureka or Dade Seam, (4) of the Etna Section.

In the south-east bank of the river just below "*The Falls*" in the eastern part of the S. W. ¼ of S. 30, T. 7, R. 10 E., there is the following out-crop:

OUT-CROP AT "THE FALLS," IN THE EASTERN PART OF S. W. ¼ OF S. 30, T. 7, R. 10 E.

(5) CONGLOMERATE (LOWER).
(4) COAL; irregular, in streaks and thick pockets, 0 to 2 ft.
(3) *Sandstones*; massive above, flaggy below, about 35 ft.
(2) COAL, 8 to 14 in.
(1) *Fire Clay;* hard and very fossiliferous, to level of water, about 4 ft.

The coal (4) is about even with the top of "*The Falls.*" It is a very hard coal and is of fine quality. The coal (2) is away back under a shelving rock. This shelving rock, for a few feet above the coal, is slabby and in places, false-bedded. It is also, as seen along the bluff, in waves from N. E. to S. W.

Farther down the river, in the N. E. ¼ of N. E. ¼ of S. 31, T. 7, R. 10 E., the coal (4) of the last section crops out in streaks and in pockets of over two feet in thickness. The changes from the thin streaks to the thick pocket, and back again to the thin streaks occur within a few feet. The gulch of Little River from "*The Falls*" on down for some ten miles to where it runs off the mountain resembles a huge newly cut ditch about one-fourth mile broad and from 200 to 400 feet deep. It is almost an impassible barrier for this whole distance, for one can descend into it on foot in only a few places, and that with difficulty. It doubtless, some miles above its mouth or before it reaches the edge of the mountain, extends down into sub-carboniferous strata. The country near it is comparatively level and in approaching it, through the under-brush, its nearness is not even suspected until the brink is reached, and the yawning chasm is almost beneath your feet. This sharpness of outline is due to the fact that the surface rock of the comparatively level country is the hard weather resisting Lower Conglomerate, and that this rock holds its own until the gulch is reached, when it suddenly breaks off in a perpendicular bluff of from 75 to 100 feet in height. There are other high bluffs in the gulch below this one, but they are not so uniform in height nor so persistent. This Lower Conglomerate forms

the large naked rock, called "*The Split Rock*," on the eastern brink of the gulf in the northern part of the N. E. ¼ of S. 11, T. 8, R. 9 E. This rock is so called from the fact that running through it in a north-east and south-west direction there is a split or crack that is some 100 yards long, about 2 feet 6 inches wide at the top and some 75 feet deep. This split at the north-east end is some 50 feet or more from the bluff, but gradually approaches it to the south-west and finally runs into it. It, the split, doubtless extends through the conglomerate and is most probably due to the conglomerate having been undermined along the bluff by weathering out of a softer underbed. Left unsupported the weight of this edge would of course tend to break or split it off from the supported portion, and, were there a joint in the rock near the unsupported edge and running somewhat with the bluff, and did the undermining amount to only a few feet in thickness, there would be a splitting along the joint, as in the above instance. The top of this rock is weathered into *sand holes*, that often resemble the impressions of large horse-tracks.

Just below or to the S. W. S. of the *split rock*, there occurs something like the following section:

SPLIT ROCK SECTION, IN N. E. ¼ OF S. 11, T. 8, R. 9, E.

(6) *Conglomerate* (*Lower*) 75 to 100 ft.
(5) DEBRIS, SANDSTONE; about 125 ft.
(4) *Slaty Sandstone*, 0 to 1 ft.
(3) COAL, 1 ft. 8 in. to 1 ft. 10 in.
(2) COAL; slaty, 4 to 6 in.
(1) *Debris*; to level of water, about 100 ft.

The Cliff Seam, if it is here, is hidden by the *Debris* (5). The coal (3) corresponds to the Dade or Eureka Seam, (4) of the Etna Section. This out-crop of coal is soft and is rusty or stained red along the seams. The dip appears to be about 10° to the W. S. W. This dip is doubtless due to waves from N. E. to S. W.

The Upper Conglomerate does not occur along here to the south-east of the river or in this county.

The coal (3) of the last section shows also on the south-east side of the mountain in the S. W. ¼ of S. 13, T. 8, R. 9 E.

OUT-CROP IN THE S. W. ¼ OF S. 13, T. 8, R. 9 E.

(7) *Sandstone;* visible 5 to 6 ft.
(6) COAL, 1 ft. 2 in.
(5) *Shale*, 2 to 3 in.
(4) COAL, 3 in.
(3) *Shale*, 3 in.
(2) *Mother of* COAL, 8 in.
(1) *Fire Clay*, 3 ft.

The dip is 15° to 20° to N. W.

The sub-conglomerate Coal Measures appear here to be some 200 feet in thickness.

About one-half mile to the north-west of the south-east crest of the mountain, there is near Mr. Jas. S. Jackson, in the N. ½ of N. E. ¼ of S. 8, T. 9, R. 9 E., an out-crop of the Cliff Seam of coal, (5) of the Etna Section. In this out-crop the coal is in the lowest strata and just at the base of the Lower Conglomerate. It is in places in thin streaks and in other places in pockets of perhaps 2 or more feet in thickness. The changes from the thin streaks to the thick pockets and back again to the thin streaks are quite sudden and most often occur within a few feet. The coal is very hard and of the very best quality. Near this coal out-crop, there is scattered over the surface a great deal of sandy or siliceous spongy limonite ore. This ore appears to have come from a stratified seam of several feet in thickness that occupies almost the indentical Geological position of the *Cliff Seam* of coal. This ore has doubtless been formed by the oxidation of carbonates or sulphides. This coal and ore out-crop seems to be on the crest of a wave from N. W. to S. E.

On a prong of Wolf Creek and some 20 feet above it, there is in a bluff of hard shales in the S. W. ¼ of S. 12, T. 9, R. 8 E., an out-crop of a seam of coal from 6 to 8 inches in thickness. The dip is about 10° to S. E. The strata here are in long gentle waves from N. E. to S. W., and in a short

distance to the north are seen to be in waves from N. W. to S. E.

Some coal is said to have been raised from surface diggings from an out-crop in the N. W. corner of S. 5, T. 10, R. 8 E. This coal probably belongs to (8) of the Etna Section.

In the N. W. corner of S. 7, T. 10, R. 8 E., there are the out crops of two seams of coal about 10 feet apart. These out-crops are only 3 to 4 inches each in thickness, and most probably belong to (9) and (10) of the Etna Section.

In the back part of a *rock-house*, under a conglomerate, in the N. W. ¼ of N. E. ¼ of S. 7, T. 10, R. 8 E., there is a pocket of coal about 5 feet long and 18 inches thick. In the line of this pocket of coal, on each side of it, are thin streaks of coal in a hard white sandstone like quartzite. This sandstone is all crumpled up. The dip appears to be 15° to 20° to the N. E. though this is doubtless due to the N. E. and S. W. wave in the strata. The strata here are also in waves from N. W. to S. E. and an irregular trough of these waves forms a bench up on the side of the mountain. The above coal out-crop is near the bottom of this trough. The conglomerate as it disappears along the north-west edge of this trough or bench has a dip of about 45° to the N. W.

9. THE COAL MEASURES OF ETOWAH COUNTY.

The Coal Measures of Etowah County are partly on Lookout Mountain and partly on Raccoon Mountain. Those of Lookout Mountain comprise the south-west end of the mountain and are some 50 square miles in extent. They with their high north-west and south-east rims show most plainly that they occupy as cynclinal trough. They are limited on the south-west by a south-east and north-west fault that brings lower cambrian strata in contact with them. The displacement along this fault is very great; it is perhaps as much as 10,000 feet. In Alabama the displacements along the cross faults, or those that seen in any other than a general north east and south-west direction are comparatively small.

The Coal Measures of Raccoon Mountain in this county are nearly separated into two parts by Bristow's Cove, or the north-east end of Murphree's Valley. They once extended over this cove or valley. They were, however, pushed up along this cove or valley into an anticlinal ridge and afterwards the ridge was removed and the present valley cut out by denudation. They are still continuous around the head of the cove or valley, and, as they now stand, cover some ninety square miles. The portion between Bristow's Cove or Murphree's Valley on the north-west and Big Wills Valley and Greasy Cove on the south-east is the north-east end of what is known as *Blount Mountain.* It is from two to three miles wide and occupies a synclinal trough with its south-east edge much higher than its north-west edge. The dip is to the north-west to within a short distance of the north-west edge when it suddenly becomes very steep to the south-east and then perpendicular. The north-west edge is for the most part a perpendicular wall of the conglomerates etc., near the base of

the measures. Just to the north-west edge of this perpendicular wall, or the perpendicular strata, and between them and the cove or valley is an immense fault. There is also a fault, a much smaller fault in many places, at least, just to the south east of the perpendicular strata.

The Coal Measures of this county answer very well to the general descriptions given in the *Introduction.*

DETAILS.

A. THE COAL MEASURES OF LOOKOUT MOUNTAIN.—The south-east edge of Lookout Mountain in this county does not appear so high and does not rise up so abruptly as farther to the north-east. This is because the sub-conglomerate and the upper sub-carboniferous measures crop out here as a narrow strip of broken country along the south-east edge of the mountain, or as spurs, etc., of the mountain. The Upper Conglomerate at the Lay Springs in the W. ½ of N. W. ¼ of S. 13, T. 10, R. 7 E., forms a bluff some 75 feet in height, and from it flows a group of several fine chalybeate springs. The water from each of these springs forms a stream of perhaps an inch in diameter, and is cold and strongly chalybeate. These springs are much more deserving than many that form popular resorts.

There is a reported coal out-crop in the S. W. ¼ of S. W. ¼ of S. 12, T. 10, R. 7 E., and in the W. ½ of N. W. ¼ of S. 12, T. 10, R. 7 E., is Mr. W. L. Watson's coal bed. The average thickness of this coal is about 10 inches, though it is said to have been 17 inches thick in one place. It is covered by a very hard shale that is full of fern impressions. These impressions are so numerous as to show on every fresh surface, though the shale be split into laminæ of no greater thickness than a sheet of writing paper. There is in this shale, resting vertically on the coal seam, the fossil trunk of a tree from 6 to 10 inches in diameter. Surrounding the stump, between it and the shale, is a thin sheet of coal. Some two feet under this coal seam is a muddy or clayey looking sandstone, without any cleavage, that is also full of fossil stem and leaf impres-

sions. The strata are here in waves from N.W. to S.E. Under this coal, 30 to 40 feet, is reported to be another seam of coal, and above it, perhaps some 50 feet, there is a coal outcrop, in the road, from 3 to 4 inches in thickness. These three seams of coal probably correspond to (8), (9) and (10) of the Etna Section.

There are reported out-croppings of coal along the western boundary of the S.W. ¼ of N. E. ¼ of S. 10, T. 10, R. 7 E., about 18 inches in thickness, and of a thin seam in the N. E. ¼ of N. W. ¼ of S. 10, T. 10, R. 7 E., and of a seam, of unknown thickness, in Black Creek in the S. W. ¼ of N. W. ¼ of S. 11, T. 10, R. 7 E.

Along the road in S's 16, 19, 20, 30 & 31, T. 10, R. 7 E., are out-croppings of two thin seams of coal from 6 to 10 feet apart. One of these out-crops probably of the lower seam, in the S. W. ¼ of N. E. ¼ of S. 16, T. 10, R. 7 E., shows athickness of 6 to 8 inches. About one-half mile farther to the south-west, or in the N. E. ¼ of S. W. ¼ of S. 16, T. 10, R. 7 E., there is along the road something like the following section:

SECTION IN N. E. ¼ OF S. W. ¼ OF S. 16, T. 10, R. 7 E.

(5) *Shale*; hard.
(4) COAL; out-cropping, 6 in.
(3) *Shale*; hard 6 to 8 ft.
(2) COAL; out-cropping, 2 ft. 6 in.
(1) *Shale*; clayey, 4 in.

About one-half mile still farther down the road, these two coal seams again make their appearance. In these last outcrops, the two coals are about 10 feet apart; the thickness shown here of the upper seam is about 4 inches, and of the lower seam about 6 inches. The coal seams are doubtless thicker than these surface out-crops. Coal has been dug in open pits from an out-cropping in the S. W. ¼ of S. W. ¼ of S. 16, T. 10, R. 7 E., that is said to reach a thickness of 16 inches, and from an out-cropping in the N. E. ¼ of N. E. ¼ of S. 20, T. 10, R. 7 E., where it is said to be 10 inches thick. These last two out-croppings are believed to be of a seam that is some 30 feet under the lower of the above two seams that

crop out along the road. These three seams most probably correspond to (8), (9) and (10) of the Etna Section.

Along the road on the side of a hill in the W. ½ of S. W. ¼ of S. 20, T. 10, R. 7 E. there is the following out-crop :

OUT-CROP IN THE W. ½ OF S. W. ¼ OF S. 20, T. 10, R. 7 E.

(6) *Shales, Flagstones;* the shales are heavy bedded, and have in them seams of flagstones, 15 to 20 ft. 0 in.

(5) *Clayey Shale;* soft, 6 to 8 in.

(4) *Black Slaty Shale,* 3 in.

(3) COAL, 10 in.

(2) *Fire Clay.* 5 to 6 in.

(1) *Shales, Flagstones;* seams of flagstones in the shale, about 10 ft.

The dip here is 6° to 8° to S. E. though the strata are in waves from N. W. to S. E. Across a depression, on the side of a hill some 75 yards to the S. W., there is an out-crop of coal about 4 inches in thickness that may be of a higher seam.

At this latter out-crop, the dip is 3° to 4° to N. W.

In the road some half-mile still farther to the south-west, or about in the N. E. ¼ of N. E. ¼ of S. 30, T. 10, R. 7 E., is another coal out-crop from 6 to 8 inches in thickness, and in the N. E. ¼ of N. E. ¼ of S. 31, T. 10, R. 7 E. there is a reported coal out-crop from 10 to 11 inches thick.

Still farther to the south-west on the side of the road near Mr. W. A. Morgan's, in the N. W. ¼ of S.W. ¼ of S. 31, T. 10, R. 7 E. are the out-crops of two seams of coal from 4 to 6 feet apart. The upper of these two seams appears to be the thicker, and it, as dug through in Mr. Morgan's well close at hand, is about 8 inches in thickness. Across a creek or branch just to the north-east of these last out-crops, the dip is from 8° to 10° to the S. E. Opposite to this point or just to the south-east of Greenwood station on the A. G. S. R. R. the sub-conglomerate measures are about 250 feet in thickness. The coal seams of these conglomerate measures have been thinning out to the south-west and along here are not over 18 inches in thickness at the greatest. The conglomerate bluffs capping the steep north-west side of the mountain show from the wagon road along Little Wills Val-

ley that they are in waves from north-east to south-west. These waves of the bluffs correspond to the waves of their strata, the high prominent points of the bluffs being the crests of the waves and the low places the troughs of the waves.

In the N. E. ¼ of N. E. ¼ of S. 36, T. 10, R. 6 E., a seam of coal about 6 inches thick crops out in a branch, and was dug through in a well, and in the N. ½ of S. E. ¼ of S. 36, T. 10, R. 6 E., is an out-crop of coal that has been dug from open pits and is most probably a foot or more in thickness. In the S. E. ¼ of S. E. ¼ of S. 36, T. 10, R. 6 E., is an out-crop of coal that is said to have been dug into to a depth of one foot without getting through it.

There are reported out-croppings of coal in S. E. ¼ of S. E. ¼ of S. 2, T. 11, R. 6 E., about 12 inches in thickness.

The above out-crop of coal are over the Upper Conglomerate and are of the three seams, (8), (9) and (10) of the Etna Section. In the N. E. ¼ of N. W. ¼ of S. 15, T. 11, R. 6 E., there is an out-crop of coal from 6 to 8 inches thick, and about one mile east and also one mile west of this locality there are said to be other out-crops of coal.

"*The Black Creek Falls*," in the S. W. ¼ of S. E. ¼ of S. 29, T. 11, R. 6 E., are over the *Lower Conglomerate*, (5½) of the Etna Section. These falls have a perpendicular height of about 75 feet and present, especially when the creek is up, a grand and beautiful sight. They are in the shape of a semi-circle and have under them an immense *rock-house** that extends from 50 to 75 feet under the falls or into the bluff. The rocks in the lower part of this bluff, in the *rock-house* under the falls, are somewhat flaggy and are in places false-bedded; those in the upper part of the bluff are massive, and along the creek, above the falls are naked over considerable areas, and show, along the joints, crevices a few feet in width and from 50 to 60 feet in depth. These rocks have a general dip of 6° to 8° to the N.W. and are in gentle waves from N. E. to S. W. The deep gulch just below the falls is some 75 yards broad. This gulch, however, does not extend very far down the creek, as the rocks, the Lower Conglomerates, which

*The spaces under overhanging cliff are called "rock houses." E. A. S.

form its perpendicular sides, soon dip below the surface, and there is formed along the creek and center of the mountain a little basin in which are exposed three seams of coal. The creek below the falls is sluggish. The dip into this little basin as shown by the coal out-crops on the N. W. side is some 15° to the S. W. The basin on the south-west side is ended abruptly by a fault or by the almost perpendicular strata along the line of fault, that cuts off or ends the mountain or Coal Measures on the south-west, and on the N. W. and S. E. sides, it has dips which are nothing more than those that are due to the inclinal or trough shape of the mountain, and which, in the bluffs along the crests of the mountain, where they are greatest, are respectively from 30° to 35° to S. E. and from 10° to 15° N.W. The coals of this little basin are about as in the following section:

OUT-CROPS ALONG BLACK CREEK, IN THE
N. E. ¼ OF S. 32, T. 11, R, 6 E.

(7) *Measures;* principally shales, perhaps to surface 30 to 50 ft.
(6) COAL; from 6 to 24 inches in thickness, will average about 1 ft 6 in.
(5) *Measures;* fire clay and shales, about 10 ft.
(4) COAL, 5 in.
(3) *Measures;* about 30 ft.
(2) COAL; variable, 4 in to 1 ft. 8 in.
(1) *Measures.*

The coal (6) has been drifted into in a dozen or more places, and has been worked on a small scale for many years for local consumption, in Gadsden. These coals are over the Upper Conglomerate and perhaps correspond to (8), (9) and (10) of the Etna Section.

Some 100 yards down the creek from the lowest of the above drifts is a ledge some 20 feet in thickness of massive rocks. These rocks are believed to be of the *Upper Conglomerate.* No pebbles were seen in them, but there are some small pieces of conglomerates scattered over the surface just to the north of them. The strike of the ledge is almost E. & W., a little N. of E. and S. of W., and the dip is 60° to 70° to S. Some 75 yards still farther down the creek, at the edge

of the mountain (or Coal Measures,) along the line of fault between them and the flatwoods or Cambrian strata, on the south-west is a ledge of conglomerates with a strike of N. 80° E., and a dip of about 80° to N. N. W. This ledge is believed to be the *Lower Conglomerate*, though I can't say for certain as the strata are badly broken up here at the south-west edge of the coal field along the line of fault. It may be that both of the above ledges are of the Upper Conglomerate along the edges of a narrow or sharp deep wave or synclinal trough with a fault on each side of it in which are engulfed the Lower Conglomerate and other strata. The direction of this trough would be almost E. & W. and the fault on the north side of it would separate it from the *little basin*, and the one on the south side would be the great fault between it and the Cambrian strata. This latter supposition is strengthened in the fact that the Upper Conglomerate or the ledge highest up the creek has a dip towards the south. This dip appears to be the regular dip, and not due to any pushing or bending over of the strata towards the north. That it is the proper dip would seem to be the case from the occurrence of the true conglomerate or pebbly rock, only on the north side of the ledge which, with the southward dip, would throw it just under or in the lower strata of the ledge just where the pebbly portions of the conglomerate most commonly occur.

Not over 100 yards to the west of Black Creek as it leaves the Coal Measures in a lagoon of the creek, and not over 5 to 6 feet above low water in the creek, and close to the line of the big fault between the Coal Measures and Cambrian strata is a *Sulphur Spring*. It is impossible to say whether this spring has its origin in the pyrites of the Coal Measures or in those of the Cambrian strata. Not over forty feet to the north of this spring, just across the road, runs the conglomerate ledge seen lowest down the creek. It here contains only a few pebbles and is badly broken up. The strike is almost E. & W., a little N. of E., and the dip is about 75° to N N W.

B. THE COAL MEASURES OF RACCOON AND BLOUNT MOUNTAINS.—The measures along their south-east edge or the south-east edge of the Raccoon Mountains from the county line on the north-east for some 15 miles to the south-west or to the north-east end of Greasy Cove, are badly broken up. In many places along this edge of the mountain, the stata are pushed or beet over to the N.W. until they are beyond the perpendicular or have a dip to the south-east. A fault occurs along this south-east edge of the mountain in which are engulfed some of its strata.

At the Horton Gap in the S. E. corner of the N. E. ¼ of S. E. ¼ of S 8, T. 10, R. 6 E., there is the following Section.

HORTON GAP SECTION IN THE
N. E. ¼ OF S. E. ¼ OF S. 8, T. 10, R. 6 E.

(7) CONGLOMERATE (UPPER), massive.
(6) COAL, 6 to 8 in.
(5) *Debris;* about 25 ft.
(4) *Sandstones;* hard and massive, bluff, 15 ft.
(3) *Debris*; about 50 ft.
(2) CONGLOMERATE (LOWER); about 30 ft.
(1) *Debris.*

The strata of this out-crop are bent over to the N. W. until the dip is 75° to 80° to the south-east. The debris (1) covers at least one seam of coal.

In the N. W. ¼ of S. E. ¼ of S. 35, T. 10, R. 5 E , the Lower Conglomerate crops out at the base of the mountain, in Fisher's Creek, and is bent over to the N. W. until the dip is about 50° to the, S. E. Some of the strata of the sub-conglomerate Coal Measures are here engulfed in the fault. Along the road in N. E. ¼ of S. 17, T. 11, R. 5 E., the dip on top of the mountain is only 6° to 8° to N. W., and then as the mountain is descended it is first 25° to 30° to N. W., then, about half-way down the mountain about 45° to N. W., then about perpendicular, and then lastly, near the foot of the mountain, it is beyond the perpendicular or is to the south-east. As the T. & C. V. R. R. descends

the mountain in a big cut about in the N. W. ¼ of S. E. ¼ of S. 18, T. 11, R. 5 E., the strata have a dip of about 35° to N. W., and then suddenly become perpendicular, and then gradually a little more than perpendicular, or get a dip of 70° to 80° to S. E. The strata as they become perpendicular are all broken up and there is here probably a fault. The big fault however is farther down the mountain or along the foot of the mountain.

On Line Creek in S. 8, T. 11, R. 5 E. is an out-crop of a seam of coal that is reported to be of good quality and to be from 18 to 20 inches thick. There are reported coal outcrops on the mountain in S. 4, T. 11, R. 5 E., from a few to eighteen inches in thickness. There are also some exposures of coal in S's 25 & 26, T. 10, R. 5 E. All of these coals are over the Lower Conglomerate and the thicker of them correspond to the Sewanee Seam, (6) of the Etna Section.

The mountain in the western part of T. 10, R 5 E., to the north-east or in the line of Bristow's Cove or Murphree's Valley is a beautiful plateau with but little undergrowth and a fine growth of grasses. The large growth consists of oak, pine and hickory. The pine is mostly short leaf pine.

The Lower Conglomerate in the western part of S. 29, T. 10, R. 5, E., at the head of Bristow's Cove, dips 20° to 25° to S. E. There is on the side of the road here two chalybeate springs, one of them rises in strata just under the conglomerate, and the other in strata just over the conglomerate. They both probably have their origin in or near thin seams of coal.

At a spring in the N. E. ¼ of S. 11, T. 10, R. 4 E., there is said to be an out-crop of coal that has been dug into to a thickness of 18 inchess without getting through it. In several wells in the western part of this same section, coal is said to have been struck. This coal as well as that at the spring is doubtless all of the same seam, the Sewanee Seam, (6) of the Etna Section, which is here probably something over 18 inches in thickness.

In T. 11, R. 4 E., there are reported two out-crops of coal

that have been worked. They also probably belong to the Sewanee Seam, (6) of the Etna Section.

Along the south-east crest of the mountain in the northern part of S. 5, T. 12, R. 4 E., the dip is about 30° to N W., while down on the S. E. side of the mountain, it is from 70° to 75° to the N. W. The slope here from the brink of the mountain to the north-west is steep and is almost equal to the dip. The mountain here is only about 2½ miles broad from rim to rim, and from the very elevated south-east rim shows most plainly its trough shape.

In the south-west corner of this county, or in the N. E. ¼ of T. 12, R. 3 E., the country is very broken and there are reported to be from four to six seams of coal exposed above the Upper Conglomerate. These coal seams are said to range in thickness from a few inches to four feet. The lowest of these seams or the first seam above the Upper Conglomerate, or (8) of the Etna Section, is reported to be from 18 to 24 inches in thickness and a seam above this one from 12 to 14 inches in thickness. These coal seams have been dug into in but a very few places and so but very little is known as to their true number, thickness and quality.

10. THE COAL MEASURES OF BLOUNT COUNTY.

The Coal Measures of Blount county cover about 460 square miles. They are of three distinct or separated areas, though they are all of the Warrior Field and beyond the limits of the county are all connected. They are, commencing with the most south-eastern, *Blount Mountain*, *Raccoon Mountain* and *Sand Mountain.* Those of Blount Mountain are separated from those of Raccoon Mountain by Murphree's Valley and those of Raccoon Mountain from those of Sand Mountain by Brown's or Blountsville Valley. See Section 2. These three areas, for the sake of convenience, will be considered separately and in the order here named.

A. The Blount Mountain Coal Measures.—Blount Mountain is nothing more than the spur or prong of Raccoon Mountain that extends down between Murphree's Valley on the north-west and the Coosa Valley on the south-east. Its general trend is N. E. and S. W. Its length, from opposite the north-east end of Bristow's Cove, or Head of Murphree's Valley, to its south-west end, is about 38 miles, and its width varies from about 2 miles at the south-west end and 2½ miles at the north-east end to about 7 miles at its widest portion, near the center. The north east end and the extreme south-west end however are respectively in Etowah and Jefferson counties, and the south-east edge is in St. Clair county, as the line between the Blount and St. Clair counties is the divide, between the waters of the Warrior and the Coosa rivers, on the south-east brink of the mountain. Blount Mountain is therefore principally in Blount county and its Coal Measures cover some 95 square miles in this county. These measures form the top of the mountain and occupy an irregular scynclinal trough whose broad south-east side takes in much the greater part of the width of the mountain. The

most elevated portion of the mountain is therefore its south-east crest and the dip over most of the width of the mountain is to the north-west. This north-west dip along the south-east crest of the mountain is about 35° but it flattens towards the north-west and finally becomes almost level for some two miles to near the north-west edge of the mountain where throughout the greater length of the mountain, it is suddenly changed into a south-east dip, and this dip rapidly gets steeper and steeper until it becomes perpendicular along the north-west edge of the mountain. These perpendicular strata are of the conglomerates and hard strata near the base of the measures, and in many places form a high perpendicular wall into which has been cut narrow gaps by the different water courses in their flow from the synclinal trough of the mountain out in the Murphree's Valley.

A short distance to the north-west of the above perpendicular strata, or between them and the valley is a *big fault*, along which there has been a vertical displacement of strata of some 8000 feet or more. This fault very gradually dies out towards the north-east and very gradually leaves the edge of the mountain towards the south-west, and so the synclinal trough is not so irregular at either end along the center of the mountain. There are also in places at least *smaller faults*, on each side of the vertical strata. Section 2 will serve to show the structure of this mountain.

The above section shows that there is a much greater thickness of strata just below and above the conglomerates on the south-east side of the mountain than on the north-west side: this is doubtless due to an engulfing of strata in the smaller faults on each side of the vertical conglomerates.

The conglomerates of the perpendicular wall along the north-west edge of the mountain in the line of the above section are not exactly perpendicular on the out-crops; the inner or *Upper Conglomerate* dipping about 80° to S. E. and the outer or *Lower Conglomerate* from 80° to 85° to N. W.

The *big fault*, or the fault to which the great irregularity of

the strata along the N. W. edge of the mountain is due, is as shown in the above section, a little farther to the north-west. It, at the point of the above section, is just to the north-west of the mountain or between the mountain and Murphree's Valley proper. At this point, there is to the south-east of the *big fault*, between it and the Coal Measures or Conglomerates, some Clinton and Sub-carboniferous strata. These strata are badly squeezed and broken up; especially the lower ones or those nearest the fault. These lower strata or the Clinton and Fossiliferous chest strata, are in places to the N. E. and S. W. of this point entirely wanting. On the opposite or N. W. side of the *big fault*, there is shown in the above section Cambrian strata that dip under Murphree's Valley or to the north-west some 40°. To the north-east and south-west of this place, however, there is to be seen the Knox Dolomite in contact with the *big fault* on the north-west side. As the *big fault* gradually dies out near the north-east end of the mountain, and gradually leaves the mountain to the south-west, and as the *smaller faults* are due to the *big one*, the *smaller faults* do not probably occur in the Coal Measures near either end of the mountain. The strata rise from near the center of the mountain towards both ends, so they are thinner at the ends than near the center.

The Coal Measures of this Mountain have been treated of by Gen. A. M. Gibson in his report on the Raccoon Mountain Coal Field, published under the auspices of the State Geological Survey in 1886. In that report it is stated that the thickest of these Coal Measures, or those that lie about flat in the above section, exceed 2500 feet in thickness and include 12 coal seams that range in thickness from a few inches to 4 feet 10 inches. Gen. Gibson commenced at the top coal seam and numbered them downward. As given by him, the upper 8 seams are over or above the *Upper Conglomerate* and the lower 3 seams are under the *Lower Conglomerate* or *Millstone Grit*, and the remaining seam, 9, is between the conglomerates, just under the *Upper Conglom-*

erate. The lowest seam, 12, is placed near the bottom of the sub-conglomerate measures.

These coal seams with the exceptions of 1 and 2, and perhaps 3, would not show, in the above section, any north-west out-crops, as they have been engulfed in the *smaller faults* on each side of the perpendicular strata. The out-croppings on the south-east side of the mountain, under the Lower Conglomerate or Millstone Grit, are of course outside of this county, as the county line is along the south-east crest of the mountain. The upper five seams occur only in the flattened measures or along and to the north-west of the Little Warrior River. They therefore do not occur near either end of the mountain, but only on the north-western side along the center of the mountain.

DETAILS.

Gen. Gibson states in his report that all 12 of the coal seams crop out in T. 13, R. 2 E., through which the above section extends, and that all but the upper two of the coal seams are exposed in T. 13, R. 3 E. He also says that there show in T. 13, R. 2 E., along the river in S's 14 and 22 the seams 4 and 5, and in S's 28 and 33 the seam 6; on Difficulty and Coal branches the seams 7, 8 and 9; on Sand Creek, in S. 27, the seams 6 and 7, and on Dearmon Creek, in S. 23, the seam 7. He also reported that there are to be seen the seam 9 in S's 2, 3, and 10, T. 14, R. 2 E., and the seam 8, on Hurricane Creek, in the eastern part of T. 12, R. 3 E., and the seams 1 and 2 in S's 19 and 24, T. 12, R. 2 E.

He states that the seams 1 and 2 are probably the best of these seams; that seam 1 is a lustrous coal and is 3 feet thick, and that seam 2 is 4 feet thick. He also says that the seam 3 is a good coal; though it is generally thin, but in places it measures nearly 4 feet in thickness; that seam 4 is reported to be of good quality and to be 4 feet thick; that seam 8 is a good coal, and on the out-crop is from 18 to 24 inches thick, and would probably thicken on being dug into; that seam 9 is good solid coal, 3 feet 8 inches thick, and that seam 10 is reported to be of

good quality and to be 4 feet thick. The other seams 5, 6, 7, and 11, he says, are most likely thin. One of these thin seams, from 12 to 14 inches thick, he reports as out-cropping in S's 19 and 20, T. 12, R. 3 E. Several exposures of coal are reported by him to be in the south-east corner of T. 13, R. 1 E., and one of these in the S. E. ¼ of S. 33, T. 12, R. 3 E., he says is 4 feet 10 inches thick. He also says that this same seam shows in S. 5, T. 14, R. 1 E., where, on the out-crop, it is 3 feet thick; and that there are many exposures of coal in this same township.

Siderite or *Spathic Iron Ore*, of seemingly good quality, is said by Gen. Gibson to occur in many places on this mountain. In the N. ½ of S. E. ¼ of S. 27, T. 13, R. 2 E., its outcrop is reported by him to show for 100 yards, and to be fully 10 feet thick; it also makes its appearance, so he says, in S's 28 and 33, T. 13, R. 2 E., and in S's 4, 16 and 20, T. 12, R. 3 E., and in the S. E. ¼ of S. 24, T. 12, R. 2 E. This last out-cropping, he thinks to be at least 10 feet thick. He says that it occurs in large quantity in the thick bed of shales that underlie the coal seam 8.

Gen. Gibson, in 1888, made the following addition to his report of 1886:

"The following *detailed Section* given in descending order will show approximately the *Strata* and *Coal Seams* in the BLOUNT MOUNTAIN *Coal Measures* at its thickest part, omitting all seams under one foot in thickness:

"Ferruginous shale-sandrock, clay, etc., to top of mountain, 40 to 60 ft.

(17) COAL.—The big seam—Payne's Bed, Smith's Bed, etc., 4 to 5 ft.

Gray crumbling sandrock; arenaceous shales, and clay iron stone and a CONGLOMERATE that disintegrates easily. The FOURTH CONGLOMERATE, 75 to 80 ft.

(16) COAL.—The *Woodward Bed*, in two benches, with clay parting.—Coal varying from 1 ft. 3 in. to 2 ft.

Hard, gnarly sand rock and arenaceous shales, 60 to 80 ft.

(15) COAL.—*Armstrong Bed*, *Carnes Bed*, etc., 3 to 4 ft.

Shales, slates, and soft sand rock, 60 to 70 ft.

(14) COAL.—In bed of Amstrong's Creek, and other places, 1 ft. to 1 ft. 6 in.

Dark slate with some fossils, 75 to 80 ft.

(13) COAL.—Thin seam, varying from 1 ft. to 1 ft. 6 in.

THIRD CONGLOMERATE, pebbles mainly in the lower part, parts of it very ferruginous, generally a coarse grained sand rock, 100 to 120 ft.

(12) COAL, in two benches.—*Washington Bed*, 2 ft. to 2 ft. 4 in.

Soft shales and thin bedded sand rock, 20 to 25 ft.

(11) COAL, in river, cut in several deep holes, thickness unknown, supposed to be 3 ft. to 5 ft.

Shale and soft sand rock, and spathic iron ore, 70 to 80 ft.

(10) COAL, near mouth of Sand Creek, 3 ft.

Sand rock and shale, 50 to 60 ft.

(9) COAL, in bluff and bed of river, above mouth of Dearmon's Creek, and in Sand Creek, 1 ft. 6 in. to 2 ft.

Slates, shales, and sand rock, 60 to 70 ft.

(8) COAL, good, clean, bright. *Lowe's Bed*, 2 ft. to 2 ft. 6 in.

Sand rock, generally hard and massive, 75 to 100 ft.

(7) COAL, good, hard, cubical. On *Coal Bed Branch*, *Dearmon's Creek*, and *Difficulty Creek*, 1 ft. 9 in. to 2 ft.

Sand rock and hard shales, 15 to 20 ft.

SECOND CONGLOMERATE, soft and crumbly, some of it easily disintegrated with hard irony members, generally pebbly, 80 to 100 ft.

Blue curly shales and slates, irony shales, and arenaceous prismatic shales, 75 ft.

(6) COAL.—*Caskie Seam*, blue underclay 1 ft thick. Coal with some clay partings, 3 ft. 8 in.

Shales and Sandstones, 60 ft.

Massive sand rock, 10 ft.

Hardblue slate, 4 ft.

(5) COAL.—*Howard Seam*, with two feet of bluish white very fine underclay. Coal with ⅛ in. slate parting, 3 ft. 6 in.

Dark gray, micaceous sand rock, much of it soft and pulverulent, making sandy soil, with clays and shales, 250 ft.

FIRST or LOWER CONGLOMERATE—hard, irony in places: some parts very pebbly, others coarse grained sand rock, 80 to 100 ft.

Shales and flaggy sand rock, 10 ft.

(4) COAL.—varying in thickness, 8 in. to 1 ft.

Ripple marked sandstone, hard shales and sand rock, with beds of clay, 150 ft.

Bluish slate (containing two beds of *yellow calcareous* rock, some of it *fossiliferous* and *crystallized*—may be local): upper part highly arenaceous, 250 ft.

(3) COAL, of fair quality, not opened; estimated thickness, 1 ft. to 2 ft.

Slate and shale, with bands of yellow and reddish clays; bands of sand rock, etc., 90 ft. to 115 ft.

(2) COAL, thin seam at base of mountain, not opened and thickness not known.

Strata covered with debris, 75 to 80 ft.

(1) COAL, thin seam found in bed of Canoe Creek, near the Hooper Gap Road, thickness unknown.

Bluish, slaty sand rock, 10 to 15 ft.

Calcareous shale—very fossiliferous—upperpart an arenaceous shale, passing into the overlying slate, 15 to 20 ft.

Carboniferous Limestone underlying base of the Coal Measures.

DETAILS.

"Since the first brief report was written, in 1886, considerable work has been done in various parts of this coal field. Portions of it have been carefully examined by owners and other interested parties. Several additional seams of coal have by this means been discovered, and some of the known seams more fully exposed. The Alabama State Land Company, which owns a large portion of this field, has had a good deal of testing done in many places. The results of their work have not been made public, and are not generally available, yet, in a few places, where their test holes and pits have been dug and left open, additional knowledge of certain coal seams has been obtained. The most important of the exposures made by this Company is in an opening on a coal seam in S. 9, T. 14, R. 2 E., between *Buck's Ridge*, and the eastern top of the mountain, the head of the middle fork of Difficulty Creek. This coal seam was opened by Mr. Howard, and is hence called the *Howard Seam*. A cut was made into the hill at right angles to the dip of the bed, hence on a level and self draining. After good coal was reached, some 20 tons of coal were taken out, and part of it, at least, hauled to Birmingham and tested. All that was taken out was taken away. Fair samples of the coal could not be seen at the mouth of the drift. And the water dammed up by debris at the mouth of the drift, prevented entrance. Information obtained from those who assisted in doing the work at this place has therefore to be relied on for details. The correctness of these statements is fully borne out

by the appearance of the bed at the mouth of the drift. It presents the following Section:

SECTION OF HOWARD SEAM, S. 9, T. 4, R. 2 E.

Cap Rock; hard massive Sand rock, at face, 12 ft.
Yellowish gray Shale and blue Slate, 10 ft.
COAL, 1 ft.
Slate, 0 to ½ in.
COAL, 2 ft. 6 in.
Fire Clay, bluish white, very fine, 2 ft.

"Total thickness of coal, 42 inches. It is of good quality: clean, bright, lustrous, and nearly free from sulphur. It is said to coke well. The structure is complicated, from face and butt structure to cubical structure. This is a very excellent seam of coal, and it is not known to have been seen at any other point. This opening is, by aneroid measurement, 350 feet above the Blackburn fork, about 100 feet below the top of *Buck's Ridge*, and 150 feet below the eastern top of the mountain. It is the first seam yet found, above the FIRST or LOWER CONGLOMERATE, and may be identical with a seam observed, at the out-crop, on Hurricane Creek near the east side of T. 12, R. 3 E. Some have supposed it to be identical with the *Caskie Seam*, that was opened in S. 3, T. 14, R. 2 E.

"The *Caskie Seam* presents the following Section:

SECOND CONGLOMERATE, Buck's Ridge; 80 to 100 ft.
Soft Shale, on Slope to S. E., no rock seen, 60 ft.
Hard prismatic Shale, 10 ft.
Blue curly Shale, and irregular Clay Slate, 2 to 4 ft.
COAL—with several thin clay partings 3 ft. 8 in.
Fire Clay dark, Sandy 1 to 2 ft.

"The coal is more cubical and less lustrous than that of *the Howard Seam*; the partings are different, and it is nearer to Buck's Ridge and at a higher elevation than the Howard Seam. No cap rock has been seen above the *Caskie Seam*, while a heavy dark gray massive sand rock, with a naked face of 10 to 12 feet, caps the *Howard Seam*. There therefore, appears to be no point of identity between these seams,

except the similarity in thickness. The Caskie Seam is two inches thicker than the Howard seam. This is but a slight difference, and by itself would be immaterial, but, in connection with all the other evidence, it is adverse to their identity.

"It may be further remarked that the Caskie Seam, from its dip must of necessity crop out on the face of Buck's Ridge, where it was opened, and cannot be found farther to the south east; and that going in that direction below the level of this seam, there comes to the surface a rock seemingly identical in color and structure with the cap rock of the Howard Seam, and at the eastern top of the mountain, about the horizon of the base of this rock, were formed fossil coal plants and other evidence of the existence of a coal seam. From all this evidence it is regarded, at least as highly probable, that the Howard and Caskie openings are on *different seams* of *coal*, and that hence two very important seams exist between the *First* and *Second Conglomerates* in the Coal Field. This is a point of much geological interest and importance, as it shows a structure very different from anything yet discovered, or known, in the WARRIOR BASIN. In that part of the field, as yet, only, one small seam of coal, about one foot thick, is reported to exist between the First and Second Conglomerates, and the whole thickness of strata between them is stated to be about or less than 100 feet, while in this field the strata intervening between these two conglomerates are, by estimation, at least 325 feet thick, and contain, as now indicated, two thick seams, aggregating over 7 feet of coal. This subject will be referred to again in the discussion and description of the *Berry Mountain Coal Measures*.

"Another important addition to our knowledge of this Coal Field has been made in recent years by the discovery and opening of a thick seam in the high lands to the S.W. of the Locust fork of the Warrior River. In T. 12, R. 3 E., at several places, this seam has been opened. In the N. W. ¼ of S. 19, an opening was made since the region was visited, and it is stated that at that place the seam is 6 feet thick,

and that the coal is of excellent quality. Openings were examined in S's 2 and 10, of said T. At the opening in S. 2, the out-crop of the bed had been stripped, and the coal taken up. It showed 3½ feet of solid and apparently excellent coal. This is known as the *Payne bed*. An opening on the same seam was also seen in S. 10, of the same T. It is known as the *Smith bed*. At this opening the coal seam measured 4 feet and appeared to be excellent coal. The coal from all these openings have gained a high reputation as a shop coal. It is said to be very free from sulphur and to coke well and easily. This seam is capped by a few feet of slate and of hard shale, and a ledge of coarse grained, purplish gray sand rock. Its position is 150 feet, by aneroid measurement, above the *Carnes bed*. Between them there is a *conglomerate rock*, thickness unknown, carrying generally large pebbles. The rock is evidently soft and easily abraded; it was not seen, but the belt of pebbles scattered over the surface from the disintegrated rock, at a certain elevation, sufficiently marked its position. This seam of coal is probably the best yet opened in the field. It is also the highest known seam, and is formed only on the highest points of the mountain, on the side next to Murphree's Valley. Whether it exists north or north-east of the Locust fork has not yet been ascertained. It is very probable, however, that it does. It does not exist south of the divide between the Locust and Blackburn forks of the Warrior.

"In the N. W. ¼ of S. 1, T. 11, R. 4 E., on the lands of Green B. Waide, a good seam of coal has recently been opened. The opening is on the face of the eastern rim of the valley, 90 feet above the bed of Bristow's Creek, which flows here near the base of the mountain. The opening, though recently made, was caved in, so that the structure of the coal could not be seen. The rocks showed the bed to have a dip of 60° to the east. The cap rock, so far as could be seen, is a hard ferruginous massive sand rock. Between the cap rock and the coal is about four feet of fine laminated

blue clay, which is probably decomposed blue slate, that will be hard, and solid farther in.

"Mr. Waide gives the following descriptive section of this bed:

COAL, 46 in.
Clay, 4 in.
COAL, 4 in.
Total thickness of bed, 54 in.

"Clean coal, 50 inches.—The coal so far as seen is of good quality. It is said to be nearly free from sulphur, and to coke well, and work well in the blacksmith forge. It has not been otherwise tested.

"About 60 feet above the *Waide Coal bed*, there were seen an out-cropping of black smut and a bold spring of chalybeate water, both indicating the existence of another bed at that level.

"Large masses of conglomerate rock are scattered along the face of the mountain, from its base to the height of 60 feet or more above the *Waide bed*. The position of this conglomerate in the face of the mountain could not be found. Some of it evidently belongs above the coal seam; possibly all of it. But whether it is the second or third conglomerate, could not be determined, and consequently the identity of this bed with any other could not be decided on. It most probably, is identical with either the *Carnes Seam*, or the *Baine Seam*, first opened in S. 8, T. 12, R. 3 E., to be hereafter described. It is evident, from the structure of the face of the mountain, that this fine seam of coal of the Waide Seam may be opened at almost any point for 8 or 10 miles along the eastern line of the valley; or from near the head of the valley to near the Locust fork of the Warrior. At, and near the river, it probably is below the water level, as the strata seem to sink in that direction to the river, and rise again to the S. W. of the Warrior.

"South-west of the Waide opening, the dip of the strata to the east, and south-east gradually diminishes, and will not be found a serious obstacle in mining.

"Should the out-cropping of smut, seen 60 feet above the Waide Seam, prove to be another workable seam of coal, this will prove a most valuable portion of the coal field. Its proximity to and easy access from the valley would add much to its importance for mining and for marketing the coal.

"The seams which crop out in, or are cut and exposed by the Blackburn fork of the Little Warrior, are the most difficult of identification. In the meanderings of that stream, coal is exposed at many places. Often in deep water, where the thickness of the bed, or the special characteristics of the coal, cannot be seen. These exposures extend for many miles in a south-west direction, that is along the strike or parallel with the strike of the coal seams. The rocky strata, and other guides, cannot be traced from point to point; nor can the relation of level to the dip of the strata be made out in the meanderings of the stream. Hence it has, so far, been impossible to determine how many coal seams are cut by this river, or to decide with certainty on the thickness of the several beds or the character of the coals. And such is the dip of the strata and the denudation on the south-east side of that stream, that, with a single exception, *no coal seam cut by it*, is found on its south-east side. That exception is a little above the mouth of Dearmon's Creek, where a bed of coal, cut by the river, was found cropping out in the bluff, 100 yards south-east of the stream.

"Several of the coal seams cut by the river are reported and believed to be thick beds. They could readily be tested by boring, but, being below water level, cannot be exposed by digging. Some of them are probably exposed in the uplift at the edge of Murphree's Valley.

"No systematic mining has yet been done in this field, and the market values or industrial adaptations of its coals have not been tested; yet, it is believed that, when practically tested, they will compare favorably with those from any other portion of the state.

"The most productive portion of this field will be found to be a belt about five miles wide, extending from the divide

between the head waters of Canoe Creek, and the Blackburn Warrior to a point opposite the head of Bristow's Cove, and adjoining Murphree's Valley on the south-east. This belt is nearly forty miles long, and contains nearly 200 square miles of very productive Coal Measures. The facility with which most of the seams may be mined, and their proximity to the valley, and thence to market, add very greatly to their prospective value.

The L. & N. R. R. in its geological researches along the located line of the Huntsville Branch of the Birmingham Mineral Railroad has done a great deal of work in testing the coal seams of Blount Mountain and of the south-west end of Raccoon Mountain. It has kindly placed in the hands of the State Geological Survey the field notes of that work, from which the following *bed sections* of test pits etc., on Blount Mountain have been taken.

BED SECTIONS OF TEST PITS ON BLOUNT MOUNTAIN, ETC., FROM THE FIELD NOTES OF THE B. M. R. R.

(1) *In a Ravine on a small Branch, some ¾ Mile South-west of Wade's Gap, or in the N. E. ¼ of N. E. ¼ of S. 33, T. 13, R. 1 E.*

Roof; slate.
COAL, 27 in.
Slate, 4 in.
COAL, 14 in.
Sandstone.

This coal gives a red ash.

(2) *About ½ Mile East of Viola on the North Bank of "Dry Branch" in the N W. ¼ of S. W. ¼ of S. 33, T. 13, R. 1 E.*

Roof; slate.
COAL. 30 in.
Shale, 7 in.
COAL, 15 in.
Sandstone.

(3) *About 1 Mile from Viola, in Warrior River Gap, on the North Bank of the River, in the N. W. ¼ of N. W. ¼ of S. 4, T. 14, R. 1 E.*

Roof; slate.
COAL, 30 in.
Shale, 3 in.
COAL, 12 in.
Sandstone.

This coal gives a red ash.

(4) *In Wade's Gap in the N. E. ¼ of S. E. ¼ of S. 27, T. 13, R. 1 E.*

Roof; slate.
COAL, 26 in.
Shale, 2 in.
COAL, 16 in.
Sandstone.

(5) *In Clowdes' Gap on the North Side of Public Road, in the N. E. ¼ of S. E. ¼ of S. 13, T. 13, R. 1 E.*

Roof.
COAL, with shale partings, 2 ft. 8 in.
Measures, about 150 ft. 0 in.
COAL, 10 in.
Measures, about 80 ft. 0 in.
COAL, 1 ft. 0 in.
Measures, about 60 ft. 0 in.
COAL, about 2 ft. 6 in.

These coal seams and measures are on their edges. The uppermost seam has the following detailed section :

Roof.
COAL, 5 in.
Shale, 2 in.
COAL, 5 in.
Shale, 12 in.
COAL, 8 in.

(6) *On the East Bank of Difficulty Creek in the S. E. ¼ of N. E. ¼ of S. 9, T. 14, R. 2 E.*

Roof; slate.
COAL, 9 in.
Shale, 2 in.
COAL, 21 in.
Fire Clay, 24 in.

This section is 70 feet within, at the end of an old drift.

(7) *On the West Side of Difficulty Creek, at the head of a Ravine. in the S. W. ¼ of N. W. ¼ of S. 14, T. 4, R. 2 E.*

Roof; sandstone.
COAL, 21 in.
Fire Clay.

(8) *On the North Side of Hullett's Gap, 50 feet from Rock Branch, in the S. E. ¼ of N. E. ¼ of S. 7, T. 14, R. 1 E.*

Roof; blue shale.
COAL, bright, 9 in.
Sandstone.

(9) *On Side of Hill 50 feet above Saw-Mill Branch in the N. E. ¼ of S. E. ¼ of S. 7, T. 14, R. 1 E.*

Roof; slate.
COAL, 9 in.
Fire Clay.

This coal is on its edge.

(10) *About 300 yards South-west of Mr. A. M. Jones' Residence, at the head of a Ravine, in the N. E. ¼ of N. E. ¼ of S. 17, T. 14, R. 2 E.*

Roof; shale.
COAL, 9 in.
Shale, 1 in.
COAL, 11 in.
Fire Clay, floor.

(11) *About 200 yards South-west of Pit (10), in the S. E. ¼ of S. W. ¼ of S. 17, T. 14, R. 2 E.*

Roof; drift, about 7 ft. 0 in.
COAL SMUT, 7¼ in.

(12) *About 150 yards West of Pit (11), in the N. W. ¼ of N. E. ¼ of S 17, T. 14, R. 2 E.*

Roof; drift, about 8 ft 0 in.
COAL SMUT, 8 in.

(13) *About 150 yards West of Pit (12), in the N. W. ¼ of N. E. ¼ of S. 17, T. 14, R. 2 E.*

Roof; drift, about 10 ft. 0 in.
COAL SMUT, 3 in.

(14) *About 200 yards West of Pit (13), in the N. E. ¼ of N. W. ¼ of S. 17, T. 14, R. 2 E.*

Roof; drift, about 12 ft. 0 in.
COAL SMUT, 4 in.

(15) *About 200 yards South of New Hope Church, on Spring Branch in the N. E. ¼ of S. W. ¼ of S. 12, T. 14, R. 2 E.*

Roof; drift, about 7 ft. 0 in.
COAL SMUT, 1 ft. 0 in.

(16) *About 100 feet above Mill Branch (Creek) on the North Side in the S. E. ¼ of S. E. ¼ of S. 11, T. 14, R. 1 E.*

Roof; shale.
COAL, 8 in.
Shale, 1 in.
COAL, 12 in.
Fire Clay; floor.

(17) *About 200 feet from Walker's Mill Branch on the North Side in the N. W. ¼ of S. E. ¼ of S. 11, T. 14, R. 1 E.*

Roof ; drift, about 5 ft. 0 in.
COAL SMUT, 1 ft. 3 in.

(18) *In head of Ravine about 300 feet from School House and 200 feet North of Walker's Mill Branch, in the N. W. ¼ of N. E. ¼ of S. 11, T. 14, R. 1 E.*

Roof; shale.
COAL, 8 in.
Shale, 1 in.
COAL, 11 in.
Fire Clay, floor.

(19) *About 300 yards South-west of Pit (18), on the West side of the South Prong of Walker's Mill Creek, in the N. E. ¼ of S. W. ¼ of S. 11, T. 14, R 1 E.*

Roof; drift, about 4 ft.
COAL SMUT, 1 ft.

(20) *On the West Side of Walker's Mill Branch, at the Head of a Ravine, in the N. E. ¼ of N. E. ¼ of S. 15, T. 14, R. 1 E.*

Roof; shale.
COAL, 10 in.
Shale, 1 in.
COAL, 10 in.
Fire Clay, floor.

(21) *About 600 yards West of Pit 20, in the N. W. ¼ of the N. W. ¼ of N. E. ¼ of S 15, T. 14, R. 1 E.*

Roof; shale.
COAL, 10 in.
Shale, 1 in.
COAL, 10 in.
Fire Clay.

(22) *On the East Side of the Branch, about 300 yards above the Saw-Mill, or in the N. W. ¼ of S. W ¼ of S 5, T. 14, R. 1 E.*

Roof.
COAL, 4 in
Measures, about 60 ft. 0 in.
COAL SMUT, 6 in.

These seams and measures are on their edges.

(23) *On the North Side of Hullett's Gap, about 300 feet up the Mountain from the Branch and 100 feet below Pit (8), in the N. E. ¼ of S. E. ¼ of S. 7, T. 14, R. 1 E.*

COAL, on edge 12 in.

Some 60 feet over pit (8) is a seam of coal 4 inches thick.

(24) *On the North Side of Straight Mountain on Terrapin Creek in Hay's Gap in the S. E. ¼ of N. W. ¼ of S. 8, T. 12, R. 3 E.*

Roof; sandstone.
Slate; blue. 48 in.
COAL, 35 in,
Slate, 4 in.
COAL, 7 in.
Slate; blue, floor.

This coal is hard and glossy. The dip 20° 30° to South.

(25) *About 200 feet North of Pit (24), in the S. E. ¼ of N. W. ¼ of S. 8 T. 12, R. 3 E.*

Roof; blue slate.
COAL, 38 in.
Slate, 2 in.
COAL, 5 in.
Slate; floor.

(26) *About 400 feet South of Terrapin Creek, in a Ravine in the N. W. ¼ of N. W. ¼ of S. 8, T. 12, R. 3 E.*

Roof; slate
COAL, 24 in.
Slate, ¼ in.
COAL, 3 in.
COAL, *Slate;* 2 in.
Slate, 5 in.
COAL, *Slate;* 3 in.
Slate; blue, floor.

The seam here has been disturbed.

(27) *About ¼ Mile South of E. C. Bynum's House, at the Head of a Small Ravine in the S. E. ¼ of S. E. ¼ of S. 7 T. 12,* R, *3 E.*

Roof; slate, blue.
COAL, 46 in.
Slate; blue.

This coal is hard, bright and curly. Dip, about 15° to N.

(28) *About 250 yards South-east of E. C. Bynum's House on the Mountain Side in the N. E. ¼ of N. E. ¼ of S. 18, T. 12, R. 3 E.*

Roof; blue strata.
COAL, 38 in.
Slate; blue floor.

This coal is hard, bright and curly.

(29) *On the North Side of Straight Mountain, in a Small Ravine in the N. W. ¼ of N. E. ¼ of S. 17, T. 12, R. 3 E.*

Roof; sandstone.
COAL, 31 in.
COAL, *Slate;* 6 in.
COAL, 4⅛ in.
Slate; blue, floor.

This coal is hard and bright.

(30) *About 800 feet East of Mr. J. McClelland's House, at the Head of a Ravine near the Summit of the Mountain, or in the S. E. ¼ of S. 8, T. 12, R. 3 E.*

Roof; sandstone.
COAL, 4 in.
COAL. *Slate*, 3 in.
COAL, 4 in.
Slate; floor.

This seam is above the conglomerate.

(31) *About ¼ Mile East of J. McClelland's House, on the South-east Side of Straight Mountain, in the Gap in the S. W. ¼ of S. 9, T. 12, R. 3 E.*

Roof; sandstone,
COAL, 19 in.
COAL, *Slate*, 12 in.
Slate; blue floor.

(32) *About ¼ Mile East of Hopper's House and 200 feet from Gum Spring, in the N. E. ¼ of S. W. ¼ of S. 4, T. 12, R. 3 E.*

Roof; slate.
COAL, 12 in.
Slate; floor.

This is the lowest seam cut in Straight Mountain.

(33) *At the Head of a Small Ravine in the S. W. ¼ of N. E. ¼ of S. 5, T. 12, R. 3 E.*

Roof; slate.
COAL, 16¼ in.
Slate, ⅛ in.
COAL, 3 in.
Slate; floor.

This pit is 30 feet below the top of the mountain.

(34) *On the Summit of the Ridge 200 feet South of Pit (33), or in the S. W. ¼ of N. E. ¼ of S. 4, T. 12, R. 3 E.*

Roof; shale.
COAL, 26⅛ in.
Slate, 1 in.
COAL, 3 in.
Slate, 1⅛ in.
COAL, 2 in.
Slate; floor.

This coal is soft and badly weathered.

(35) *In the Head of Ravine, 500 feet South of Pit (34), in the S. E. ¼ of N. E. ¼ of S. 4. T. 12, R. 3 E.*

Roof; shale.
Shale, bituminous, 10 in.
COAL, 26⅛ in.
Clay, 1 in.
COAL, 3⅛ in.
Clay, ⅛ in
COAL, 5 in.
Slate; floor.

This coal is hard and bright.

(36) *On the Side of Straight Mountain ⅛ miles West of W. A. Coles' House, or in the N. W. ¼ of S. 3, T. 12, R. 3 E.*

Roof; sandstone.
COAL, 16 in.
Fire Clay; floor.

This coal is soft and weathered on the out-crop.

(37) *On the Side of Straight Mountain 25 feet below Pit (36), in the N. W. ¼ of S. 3, T. 12, R. 3 E.*

Roof; shale.
COAL, *Clay;* 1 in.
COAL, 2 in.
COAL, *Clay;* 1 in.
Clay; shaly, floor.

(38) *The "Payne Opening," in Ravine near the top of Mountain, in the S. E. ¼ of S. E. ¼ of S. 34, T. 11, R. 3 E.*

Roof; blue slate.
COAL, 16 in.
MINERAL CHARCOAL, 3 in.
COAL, 7 in.
Slate; hard, floor.

This coal is hard and curly.

(39) *About 50 feet below Pit (38), in Gully in the S. E. ¼ of S. E. ¼ of S. 34, T. 11, R. 3 E.*

Roof: slate.
COAL, 5 in.
Slate; floor.

This coal is hard and bright, and has a *face and butt structure.*

(40) *On Hill Side 75 feet East of Gadsden Road in S. 34, T. 11 R. 3 E.*

Roof; slate.
COAL, 5 in.
Slate; blue, floor.

(41) *The "Smith Opening" in the S. E. ¼ of S. E. ¼ of S. 35, T. 11, R. 3 E.*

Roof; slate, blue.
COAL, 35 in.
Slate; blue, floor.

This coal is hard, bright and curly.

(42) *On the Side of Raccoon Mountain about 50 feet below Pit (41), in the S. E. ¼ of S. E. ¼ of S. 35, T. 11, R. 3 E.*

Roof; arenaceous shale.
COAL, 8 in.
Slate; blue, floor.

(43) *In Bed of Branch 150 feet North-east of Pit (28), in the N. E. ¼ of N. E. ¼ of S. 18, T. 12, R. 3 E.*

Roof; drift.
COAL, 32 in.
Mineral Charcoal, ½ in.
COAL, 4 in.
Slate; blue, floor.

This pit is 20 feet under pit (28); on being driven into 20 feet, the roof becomes a hard slate. The coal is hard and curly, and the mineral charcoal does not extend across the pit.

(44) *About 300 feet North-east of Smith's House on the Side of a Ravine in the N. W. ¼ of S. E. ¼ of S. 36, T. 11, R. 3 E.*

Roof; slate.
Clay, COAL; 4 in.
Slate, 34 in.
COAL, 3 in.
Slate, 5 in.
COAL, 9 in.
Slate; floor.

(45) *About ¼ Mile East of Smith's House in bed of Branch in the N. E. ¼ of S. E. ¼ of S. 36, T. 11, R. 3 E.*

Roof; slate.
COAL, 4 in.
Slate, 9 in.
COAL, 8 in.
Slate; floor.

(46) *About 20 feet East of Gadsden Road in the N. E. ¼ of S. E. ¼ of S. 36, T. 11, R. 3 E.*

Roof; shale.
COAL, 5 in.
Fire clay.

This coal is dirty and weathered.

(47) *About 10 feet above Pit (46), in the N. E. ¼ of S. E. ¼ of S. 36' T. 11, R. 3 E.*

Roof; slate.
COAL, 6 in.
Slate; floor.

(48) *Near Summit of the Mountain, about 120 feet above Pit (44), in the N. W. ¼ of S. E. ¼ of S. 36, R. 3 E.*

Roof; red clay.
COAL, 5 in.
Fire clay; floor.

(49) *At the Head of a small Ravine on the North-west Side of Straight Mountain in the S. E. ¼ of S. E. ¼ S. 16, T. 11, R. 4 E.*

Roof; slate.
COAL, 4 in.
Slate; floor.

B. THE RACCOON MOUNTAIN COAL MEASURES.—Raccoon Mountain, as has been stated, is separated from Sand Mountain by Brown's Valley, and so after this valley dies out on the south-west, just within Blount County, the two mountains become one, or are blended together into a mountainous country that gradually merges into the basin area of the Warrior Coal Field.

The portion of Raccoon Mountain that is within this county is its south-west end or that portion that lies between Murphree's and Brown's valleys. Its Coal Measures, as they form the top of the mountain, are, of course co-extensive with the mountain, and cover in this county some 235 square miles. They form a broad flat synclinal trough with the edges next to the valleys, but slightly elevated, and the central portion badly cut up or denuded by the Locust fork of the Warrior River and its tributaries. The general dip along the south-east edge is about 20° to N. W., while that along the north-west edge is only 10° to 12° to S. E. These dips, however, gradually diminish as the edges are left, or towards the interior of the mountain. In places, at least, the strata are in waves from N. W. to S. E. and

also from N. E. to S. W. Those from N. E. to S. W. appear to be much longer and flatter, or more gentle, than those from N. W. to S. E. These latter along the edges of the mountain are especially short and sharp. There is also a small general dip towards the south-west or towards the *basin area* of the Warrior Field, and so the thickest measures are along the county line on the south-west. These thickest measures are believed to be some 1800 feet in thickness and to include over 20 coal seams that range in thickness from a few inches to some seven feet. These seams include those of the Blount Mountain section, though they are not believed to be altogether as thick in this mountain as they are said to be in Blount Mountain. The uppermost five to six of these seams including the thickest one, the well known New Castle seam, come up into this county but a short distance, some four miles, or cover but a small area in the county 8 to 9 square miles, while the lowest three of these seams, or those under the *Upper Conglomerate*, if they occur in here, underlie about all of the Coal Measures in the county. One of these three seams or a higher seam crops out in Gurley's Creek in S. 29, T. 14, R. 1 W., where it is said to be 22 inches thick. Farther down Gurley's Creek, in the neighborhood of Smith's Mill, in the N. E. ¼ of N. E. ¼ of S. 23, T. 14, R. 2 E., are several reported out-crops of coal which are probably of the uppermost seams. One of these seams in an out-crop in the creek about one-half mile above the mill is said to be 4 feet 4 inches thick, and to have no slate partings. An out-crop in the road at the mill shows about 12 inches in thickness of coal smut with a fire-clay underbed. In S's 2 and 12, T. 14, R. 2 W. are out-crops of coal that are said to be respectively 3 feet 4 inches and 5 feet 7 inches in thickness. They are also doubtless of the uppermost seams.

Near the south-east edge of the mountain, in S. 16, T. 14, R. 1 W., there is an out-crop of coal that is reported to be 3 feet 4 inches thick. In the southern part of S. 8, T. 14, R. 1 W., are the reported out-crops of two seams of coal. The upper one is thought to be about 4 feet thick and the lower

one 3 feet thick. To the north and north-east of these last out-crops, for a long distance, the exposures of coal are said to be thin. In the river near the county line, there is said to be a seam of coal from 3 to 4 feet thick. This coal, during low stages of the water, was raised and loaded on flat-boats, which, in time of freshets, were floated down to Tuscaloosa and Mobile.

In the wells on the high-lands near the south-west corn er of S. 27, T. 13, R. 2 W., a seam of coal about 2 feet thick is said to have been struck. A thin coal seam is said to crop out from under bluffs of shale in the N. E. ¼ of S. 29, T. 13, R. 2 W. There is also said to be an out-crop of coal in the river, in S. 25, T. 13, R. 2 W. For the true thickness etc., of the above coal seams see below the *bed sections*, taken from the field notes of the L & N. R. R. along the located line of the Huntsville branch of the Birmingham Mineral Railroad. These *bed sections* also cover the coal out-crops farther to the north-east, including those of Berry Mountain, between the Locust fork of the Black Warrior River, on which there is also given a report by Gen. A. M. Gibson.

The conglomerate bluff along the north-west edge of Raccoon Mountain, next to Brown's Valley, show in many places that they, as well as the accompanying strata, are in waves from north east to south west, and also from north west to south-east. As every where seen, those from north-east to south-west are long shallow waves, and those from north-west to south-east, along the crest of the mountain, are short sharp waves or crumples in the strata. These conglomerates, the Lower and Upper Conglomerates of Tennessee, often form naked glady places along this crest of the mountain. On the side of the mountain under the Lower Conglomerate, there have been seen a few out-crops of the *Cliff Seam*. One of these occur, at the south-west end of the Blountsville Valley, in a cut on the L. & N. R. R. near Reed's Gap. It is about one foot in thickness.

The *Chalybeate Springs* on the side of the mountain and the Blount Springs and Birmingham wagon road in the N.

E. ¼ of S. 19, T. 13, R. 2 W., probably have their origin in a thin sub-conglomerate coal seam.

Along the foot of the mountain or the south-east edge of the Blountsville Valley, in the Mountain Limestones, in T. 12, R's 1 and 2 W., are some *big* sinks which drain large coves in the valley. The waters of these coves after disappearing in the big sinks and flowing under the high mountain rim, of principally the Lower and Upper Conglomerates, make their appearance to the south-east of this high rim and flow to the south-east, over Coal Measures, into the Locust fork of the Black Warrior River. During heavy freshets these sinks cannot carry off the water fast enough, so it backs up against the mountain and over the sinks, some times to a depth of 25 to 30 feet. The edge of the mountain along here is very ragged; it is indented with deep coves, and high promontories capped with the conglomerates, usually the lower conglomerate extend out from it into the valley between the coves.

The *Cliff Seam* shows at the *Cave Spring* in the south-east corner of S. 10, T. 11, R. 1 E., where it is about 10 inches thick. It is here a poor coal. The rocks over this exposure of coal are thick flagstones that form a bluff some 75 feet high, though just to the north-east and south-west of this point the same bluff is a massive conglomerate, Millstone Grit.

The *Cave Spring* is a semi-cone shaped hole or sink against the foot of this bluff. It is always partly filled with water that is usually within about 20 feet of the top of the cave, though, it is said, in times of freshets to get several feet higher. The water has a bluish color and looks to be of great depth. Water is always trickling over the bluff, which during the summer months is covered with a growth of beautiful and rare ferns. The sub-conglomerate measures are here thin and it is probable that the *Cave Spring* extends down into sub-carboniferous limestone. The dip is 10° to 15° to S. E.

On the side of the mountain, just under the Lower Conglomerate or Millstone Grit bluff, in the N. E. ¼ of N. E. ¼ of S. 19, T. 10, R. 2 E., there is considerable *brown ore*. It

is said to be in places ten feet thick. Most of it is sandy, or is made up of alternate streaks of very hard compact ore and very siliceous or sandy matter.

In Dry Creek, the head waters of Big Spring Creek, there is, in the S. E. ¼ of S. E. ¼ of S. 18, T. 10, R. 2 E., at the foot of the mountain, a showing of coal. This coal is doubtless part of a slide, as it is in the sub-carboniferous valley, and as there are sub-carboniferous strata in places near it and beween it and the mountain or the edge of the Coal Measures. The debris around it is of the Coal Measures, and has in it considerable good brown ore in nodules of peculiar shapes that are stringy and full of holes. This ore is believed to be the same as that seen on the side of the mountain under the Millstone Grit bluff, and it must have come down in the slide with the coal from the bluffs near the top of the mountain, now about one-half mile distant to the south-east. There are also along with this ore some irregular nodules or pebbles of chert, and just across the creek from it there is some little manganese ore. Near this ore is a well from which there is said to have been taken, 30 to 40 feet below the surface, some hickorynuts and charcoal. This could also be accounted for by the slide that brought the coal down. This well is just to the east or south-east of the sub-carboniferous or LaGrange Sandstone in ledges which probably stopped the slide.

In the road up the mountain in the N. E. ¼ of S. 34, T. 9, R. 2 E., near the county line, there is an out-crop of the coal seam (4) or (5) of the Etna Section. This out-crop is from 10 to 15 feet under the Millstone Grit, with flaggy sandstones between. Some 35 feet under this coal is a showing of the brown ore in a stratified seam. The ore of this out-cropping appears to be of very good quality.

BED SECTIONS OF TEST PITS ON COAL OUT-CROPPINGS, ETC., OF RACCOON MOUNTAIN; FROM FIELD NOTES OF THE B. M. R. R.

(*1*) *Near the Head of North Creek on the North-east Side in S. E .¼ of S. W. ¼ of of S. 26. T. 15, R. 2 W.*

Cap Rock; Shale.
COAL, 32 in.
Fire Clay.

This coal seam was not identified. The Coal has a red ash.

(*2*) *On the South-west Side of North Creek, 300 yards below* (*1*), *or in the S. W. ¼ of S. W. ¼ of S. 26, T. 15, R. 2 W.*

Cap Rock; shale, 60 in.
COAL. 50 in.
Fire Clay.

Can not identify this seam. Considered the finest seam cut on Raccoon Mountain. The dip is 55° to N. 50° W. The coal has a red ash.

(*3*) *On the North-west Side ot North Creek, about 200 yards below* (*2*), *or in S. W. ¼ of S. W. ¼ of S. 26, T. 15, R. 2 W.*

Roof; shale, 48 in.
COAL, 13 in.
Shale, 4 in.
COAL, 5 in.
Shale, 6 in.
COAL, 12 in.

This seam is 75 feet under the *Black Creek Seam*. The dip is 19° to 30° W. The coal has a red ash.

(*4*) *On the South-west Side of North Creek, 500 yards below* (*3*), *or in the N. E. ¼ of S. E. ¼ of S. 26, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 24 in.
Fire Clay.

Supposed to be the *Black Creek Seam*. The coal has a red ash.

(5) *On North Bank of a Branch of North Creek, in the N. E. ¼ of S. E. ¼ of S 27, T. 15, R. 2 W.*

Roof; shale.
COAL, 30 in.
Clay.

This is supposed to be the *Jefferson Seam;* it is about 30 feet above (4).

(6) *On the South-west Side of Turkey Creek, in the N. W. ¼ of N. E. ¼ of N. E. ¼ of S. 25, T. 15, R. 2 W.*

Roof; shale.
COAL, 20 in.
Fire Clay.

This is the *Hanby Old Mill Seam.* It is believed to be the same seam as (1). The coal has a red ash.

(7) *On Turkey Creek, 100 yards from the South-west Bank, in the N. W. ¼ of N. E. ¼ of S. 25, T. 15, R. 2 W.*

Roof; shale, 115 in.
COAL, 21 in.
Fire Clay.

Believed to be the same seam as (2). The coal ash is red.

(8) *On the South-west Side of Turkey Creek, ¾ Mile below* (7), *or in the S. W. ¼ of N. E. ¼ of S. 24, T. 15, R. 2 W.*

Roof; shale.
COAL, 8 in.
Slate, 1 in.
COAL, 6 in,
Slate, 1 in.
COAL, 18 in.

This is considered to be the *Jefferson Seam.*

(9) *On the South-west Side of Turkey Creek, ¾ Mile below (7), or in the S. W. ¼ of N. E. ¼ of S. 24, T. 15, R. 2 W.*

Roof; shale.
COAL, 26 in.
Shale and *Fire Clay*.

This seam is 40 feet below (8) and is thought to be the *Black Creek Seam*.

(10) *On the North-west Bank of Turkey Creek, some 50 yards from the Creek, in the S. W. ¼ of S. 13, T, 15, R. 2. W.*

Roof; shale.
COAL, *Shale*; mixed, 12 in.
COAL, 25.
Fire Clay.

This is thought to be the *Jefferson Seam*.

(11) *On the North-west Side of Turkey Creek, ½ Mile North-east of (10), or in the N. E. ¼ of S. 13, T. 15, R. 2 W.*

Roof; shale.
COAL, 7½ in.
Shale, 2 in.
COAL, 6 in.
Shale, 1 in.
COAL, 7 in.
Fire Clay.

This is thought to be the *Jefferson Seam*.

(12) *On Turkey Creek, 100 yards North-east of (11), or in the N. E. ¼ of S. W. ¼ of S. 13, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 16 in.
COAL, *Clay;* mixed, 9 in.

This is thought to be the *Black Creek Seam*.

(13) *On the North-east Bank of North Creek, about One Mile above its Junction with Turkey Creek, or in the N. W. ¼ of S. W. ¼ of S. 22, T. 15, R. 2 W.*

Roof; slabby sandstone.
COAL, 11 in.
Shale; blue.

(14) *On the South Bank of North Creek, ½ Mile above its Junction with Turkey Creek, or in the N. E. ¼ of N. E. ¼ of S. 21, T. 15, R. 2 W.*

Roof; shale.
COAL, 5 in.
Shale.

(15) *Out-crops on Public Road near Ben Taylor's Mill, or in the S. E. ¼ of N. W. ¼ of S. 15, T. 15, R. 2 W.*

Roof; clay and shale.
COAL, 7 in.
Clay.

(16) *On the Divide between Self and Turkey Creeks, in the S. W. ¼ of N. W. ¼ of S. 11, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 22 in.
Shale, 1 in.
COAL, 11 in.
Clay, blue 34 in.
COAL, 31 in.

Thought to be the "*New Castle Seam.*"

(17) *On the Divide between Self and Turkey Creeks ¾ Mile East of (16), or in the S. E. ¼ of N. E. ¼ of S. 11, T. 15, R. 2 W.*

Roof; sandstone.
COAL, poor, 6 in.
Shale, 1 in.
COAL, 23 in.
Shale, 1 in.
COAL, 19 in.
Shale, 28 in.
COAL, 25 in.
Shale.

Thought to be the "*New Castle Seam.*"

(18) *On the South-west Bank of a Branch of Self's Creek, in the N. E. ¼ of N. W. ¼ of S. 18, T. 15, R. 1 W.*

Roof; shale.
COAL, 1 in.
Clay.

(19) *On Public Road, ½ Mile North of Self's Creek, in the S. W. ¼ of N. E. ¼ of S. 7, T. 15, R. 1 W.*

Roof; shale,
COAL, 1 in.
Clay.

(20) *South of Self's Creek ¼ Mile, or in the S. E. ¼ of S. W. ¼ of S. 12, T. 15, R. 2 W.*

Roof; shale.
COAL, 13 in.
Shale, 2 in.
COAL, 22 in.
Shale.

This is considered the *Jefferson Seam.*

(21) *About 300 yards South-east of Self's Creek, in the S. E. ¼ of S. W. ¼ of S. 12, T. 15, R. 2 W.*

Roof; slate.
COAL, 24 in.
Slate, Fire Clay.

This is thought to be the *Black Creek Seam;* it is about 25 feet below the *Jefferson Seam.*

(22) *South of Self's Creek about ¼ Mile, in the S. E. ¼ of S. W. ¼ of S. 12, T. 15, R. 2 W.*

Roof; slate.
COAL, 4 in.
Shale, 3 in.
COAL, 23 in.
Fire Clay.

Thought to be the *Jefferson Seam.*

(23) *Some 950 feet South-east of Self's Creek, in the S. E. ¼ of S. W. ¼ of S. 12, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 29 in.
Fire Clay.

This is the *Jefferson Seam;* it is about 25 feet above the *Black Creek Seam.*

(24) *Some 150 yards South of Self's Creek, in the N. ½ of S. W. ¼ of S. 12, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 16 in.
Shale, 1 in.
COAL, 18 in.
Fire Clay.

Thought to be the *Jefferson Seam.*

(25) *On a Small Branch, some 125 yards South-west of Self's Creek, in the S. W. ¼ of N. W. ¼ of S. 12, T. 15, R. 2 W.*

Roof; slate.
COAL, 33 in.
Fire Clay.

This coal is of a dull color, without luster; it is thought to be the *Black Creek Seam.*

(26) *On a Small Branch, some 180 yards South-west of Self's Creek, in the S. W. ¼ of N. W. ¼ of S. 12, T. 15 R. 2 W.*

Roof; shaly clay.
COAL, 10 in.
Shale, COAL, 36 in.
COAL, 4 in.
Fire Clay.

(27.) *On side of public road, about* 150 *yards north-east of Self's creek, in the S. W. ¼ of N. W. ¼ of S. 12, T. 15, R. 2* W.

Roof; shale.
COAL, 28 in.
Fire Clay.

Thought to be the *Jefferson Seam.*

(28) *On the South-west bank of Self's creek, in the N. W. ¼ of N. W. ¼ of S. 12, T. 15, R. 2 W.*

Roof; sandstone.
COAL, *Slate ;* mixed, 6 in.
COAL, 17 in.
Shale, 3 in.
COAL, 25 in.
Shale.

Thought to be the *Jefferson Seam.*

(29) *On the South-west Bank of Self's Creek in the S. W. ¼ of N. W. ¼ of S. 12, T. 15, R. 2 W.*

Roof; slate.
COAL, 38 in.
Fire Clay.

This is the "*Black Creek Seam;*" the coal is of a dull color and has no luster.

(30) *On the North-east Side of Self's Creek, on a Small Branch in front of Mr. Samuel Faucett's Residence, in the N. W. ¼ of N. W. ¼ of S. 12, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 16 in.
Slate, 2 in.
COAL, 18 in.
Sandstone.

Thought to be the *Jefferson Seam.*

(31) *On the North-east Side of Self's Creek and on the West Side of Mr. Samuel Faucett's Residence, or in the N. E. ¼ of N. E. ¼ of S. 11, T. 15, R. 2 W.*

Roof; slate.
COAL, 15 in.
Fire Clay.

(32) *On the Right Bank of a Small Branch some ¾ mile from where it empties into Self's Creek near Mr. Samuel Faucett's Residence, or in the N. W. ¼ of S. W. ¼ of S. 1, T. 15, R. 2 W.*

Roof; shaly clay.
COAL, 32 in.
Hard shaly clay.

This is thought to be the *Black Creek Seam.*

(33) *In S. E. ¼ of S. E. ¼ of S 2, T. 15, R. 2 W.*

No roof.
COAL, 2 in.

Thought to be a portion of the *Jefferson Seam.*

(34) *North-east of Self's Creek about ¾ mile, or in the S. W. ¼ of N. W. ¼ of S. 1, T. 15, R. 2 W.*

Roof: slate.
COAL, 27 in.
Fire Clay.

Thought to be the *Black Creek Seam.*

(35) *In front of Mr. D. Faucett's Residence and about ½ mile North-east of Self's Creek, or in the S. W. ¼ of N. W. ¼ of S. 1, T. 15, R. 2 W.*

Roof; slate.
COAL, 20 in.
Slate, 12 in.
COAL, 16 in.
Fire Clay.

Thought to be the *Jefferson Seam.*

(36) *East of Self's Creek* 1½ *miles, or in the N. W. ¼ of S. W. ¼ of S. 26, T. 14, R. 2 W.*

Roof; slate.
COAL, 9 in.
Slate, 1 in.
COAL, 7 in.
Fire Clay.

(37) *South-west of Self's Creek ¾ mile, or in the S. E. ¼ of N. W. ¼ of S. 10, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 18 in.
Slate, 1 in.
COAL, 15 in,
Fire Clay.

This coal gives a white ash.

(38) *North-east of Self's Creek, ¼ mile, or in the N. E. ¼ of S. E. ¼ of S. 2, T. 15, R. 2 W.*

Roof; slate.
COAL, 8 in.
Slate, 1 in.
COAL, 4 in.
Fire Clay.

Thought to be the *Jefferson Seam.*

(39) *North-east of Self's Creek ⅛ mile, or in the N. W. ¼ of S. W. ¼ of S. 2, T. 15, R. 2 W.*

Roof; slate.
COAL. 9 in.
Fire Clay.

(40) *North-east of Self's Creek 100 yards, or in N. W. ¼ of N. E. ¼ of S. 2, T. 15, R. 2 W.*

Roof; slate.
COAL, 16 in.
Fire Clay.

(41) *North-east of Self's Creek ¼ mile, or in the N. W. ¼ of S. W. ¼ of S. 2, T. 15, R. 2 W.*

Roof; shaly clay.
COAL, 10 in.
Shaly Clay, 13 in.
COAL, 2 in.
Fire Clay.

(42) *North-east of Turkey Creek* 1½ *miles, or in the S. E. ½ of S. 4, T. 15, R. 2 W.*

Roof; sandstone.
Clay, COAL ; mixed, 18 in.
COAL, 9 in.
Shale, 2 in.
COAL, 6 in.
Clay, 9 in.
COAL, 12 in.
Fire Clay.

Supposed to be the *New Castle Seam.*

(43) *On the Divide between Turkey and Self Creeks, One Mile North-east of Turkey Creek, or in the N. W. ¼ of S. E. ¼ of S. 9, T. 15, R. 2 W.*

Roof; sandstone.
Shale, COAL, 30 in.
Shale, 12 in.
Fire Clay, COAL, 13 in.
Shale, COAL, 24 in.
COAL, 15 in.
Slate, 2 in.
COAL, 19 in.
Shale, 2½ in.
COAL, 6 in.
Shale, 2 in.
COAL, 12 in.
Fire Clay.

Supposed *New Castle Seam.*

(44) *North-east of Turkey Creek ¾ mile, or in the N. W. ¼ of S. E. ¼ of S. 11, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 24 in.
Clay, 1 in.
COAL, 18 in.
Fire Clay, 14 in.
COAL, 36 in.
Fire Clay.

Supposed *New Castle Seam.*

(45) *North-east of Turkey Creek ¼ mile, or in the N. W. ¼ of S. E. ¼ of S. 7, T. 15, R. 2 W.*

Roof; shale.
COAL, 10 in.
Shale, COAL, 14 in.
COAL, 24 in.
Fire Clay.

Supposed *New Castle Seam.*

(46) *North-east of Self's Creek ¼ mile, or in the N. E. ¼ of N. W. ¼ of S 3, T. 15, R. 2 W.*

Roof; shale.
Clay, COAL, 10 in.
COAL, 10 in.
Clay, 2 in.
COAL, 5 in.
Sandstone.

Couldn't identify this seam.

(47) *South-west of Self's Creek ¼ mile, or in the N. E. ¼ of N. W. ¼ of S. 3, T. 15, R. 2 W.*

Roof; shale.
COAL, 8 in.
Clay.

This seam is about 20 feet above (46).

(48) *Under Falls on Beech Branch ½ mile North-east of Turkey Creek, or in the N. W. ¼ of N. W. ¼ of S. 8, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 3 in.
Shale, 8 in.
COAL, 32 in.
COAL, *Shale*, 4 in.
Sandstone; soft.

Supposed *New Castle Seam.*

(49) *In Bottom on Side of Beech Branch ½ mile North-east of Turkey Creek, or in the N. E. ¼ of N. W. ¼ of S. 8, T. 15, R. 2 W.*

Roof; slate.
COAL, 17 in.
Shale, 1½ in.
COAL, 17 in.
Fire Clay.

Thought to be *New Castle Seam.*

(50) *On the Morris Station Road ¾ mile North-east of Turkey Creek, or in the S. W. ¼ of N. W. ¼ of S. 9, T. 15. R. 2 W.*

Roof; shale.
COAL, 2 in.
Shale, 1 in.
COAL, 28 in.
COAL, *shale*, 8 in.
Fire Clay.

Supposed *New Castle Seam.*

(51) *On Side of Morris Station Road, in Front of John Self's Residence, ½ mile north-east of Turkey Creek, or in the N. W. ¼ of S. W. ¼ of S. 9, T. 15, R. 2 W.*

Roof; shale.
COAL, 4 in.
COAL, *Clay*, 6 in.
COAL, 32 in.
COAL, *Shale*, 4 in.
Fire Clay.

Supposed *New Castle Seam.*

(52) *North-east of Turkey Creek ½ mile, 300 yards from (51), or in the S. W. ¼ of S. W. ¼ of S. 9, T. 15, R. 2 W.*

Roof; sandstone.
COAL, 6 in.
Clay, 8 in.
COAL, 8 in.
Shale.

This seam is about 25 ft. above the *New Castle Seam.*

(53) *On Small Tributary to Beech Branch, ½ mile North-east of Turkey Creek, or in the N. W. ¼ of N. W. ¼ of S. 8, T. 15, R. 2 W.*

BLACK BAND ORE; estimated, 2 to 3 feet.

(54) *On Public Road ¼ mile North-east of Turkey Creek, or in the N. W. ¼ of S. W. ¼ of S. 9, T. 15, R. 2 W.*

Roof; shale.
COAL, 9 in.
Clay, 1 in.
COAL, 36 in.
Fire Clay.

(55) *On Side of Hill ¾ mile North-east of Turkey Creek, or in the N. W. ¼ of S. W. ¼ of S. 11, T, 15, R. 2 W.*

Roof; sandstone.
COAL, 11 in.
Shaly Clay.

(56) *On the Side of Self's Creek in the N. W. ¼ of S. E. ¼ of S. 12, T. 15, R. 2 W.*

Roof; shale.
COAL, 2 in.
Shale.

(57) *On Small Tributary to Beech Branch ½ mile North-east of Turkey Creek, or in the N. E. ¼ of N. W. ¼ of S. 8, T. 15, R. 2 W.*

Roof; sandstone.
BLACK BAND ORE, 27 in.
Sandstone.

(58) *On Beech Branch about 200 yards above the Falls, or in the N. W ¼ of N. W. ¼ of S. 8, T. 15, R. 2 W.*

Roof; sandstone.
Shale, BLACK BAND, 22 in.
BLACK BAND, 44 in.
Shale, BLACK BAND, 10 in.
Sandstone.

This *Black Band* is about 30 ft. over the coal seam cut under *the falls*. The dip is 1° 30′ to S. 45° E. About 100 ft. higher up the ravine and 15 ft. above the test pit (58), the *Black Band* shows in a seam six inches thick and then disappears.

(59) *At Small Branch on Country Road, one mile North of Turkey Ck. and ¼ mile South of Lick Ck., or in the S. W. ¼ of S. W. ¼ of S. 4, T. 15, R. 2 W.*

Roof; shale, 12 in.
Shale, clay, 6 in.
BLACK BAND, 36 in.
Sandstone.

(60) *On Road Leading to Warrior River, ½ mile South of the River, or in the S. W. ¼ of S. E. ¼ of S. 29, T. 14, R. 2 W.*

Roof; clay.
COAL, shaly, 10 in.
Shale.

(61) *Under a Bluff, 15 ft. Hhgh of Shale, along a Branch on the Road Leading to Warrior River, about 500 feet South of the River, or in the N. W. ¼ of S. W. ¼ of S. 29, T. 14, R. 2 W.*

Roof; shale, greyish and blackish.
COAL, 15 in.
Slate, 2 in.
COAL, 9 in.
Shale; bluish grey with impressions of twigs, etc.

(62) *On Side of Country Road Leading to Warrior River, ¼ mile South of River, or in the N. W. ¼ of S. W. ¼ of S. 29, T. 14, R. 2 W.*

BLACK BAND ; out-crops, 24 in.

Cut into to a depth of 2 ft., too hard to cut through, the *Black Band* becoming more hard and shaly.

(63) *In the Bluff on the South Bank of the Warrior River, 100 ft. above the River, and 300 ft. East of Country Road, or in the S. W. ¼ of S. 29, T. 14, R. 2 W.*

Roof; shale.
COAL, 10 in.
Shale.

This coal gave out on being drifted in on 15 ft.

(64) *In the Bluff on the South Bank of the Warrior River, 75 ft. above the River and 300 ft. East of Country Road, or in the S. W. ¼ of N. W. ¼ of S. 29, T. 14, R. 2 W.*

Roof; sandstone.
COAL, shaly and inferior, 17 in.
Blue clay.

(65) *On the East Side of Self's Creek, 40 ft. above Low Water Level, in the S. W. ¼ of S. E. ¼ of S. 21, T. 14, R. 2 W.*

Roof; clay and shale.
COAL; shaly, 13 in.
COAL, 5 in.
Fire clay.

(66) *On West Bank, 75 ft. above Low Water Level, ¼ mile below Junction of Gurley and Self Creeks, or in the S. W. ¼ of N. E. ¼ of S. 21, T. 14, R. 2 W.*

Roof; shaly clay.
COAL, 10 in.
Clay, 8 in.
COAL, 4 in.
Fire clay.

Supposed *New Castle Seam.*

(67) *On West Bank, 5 ft. above Low Water Level, ¼ mile below Junction of Gurley and Self Creeks, or in the S. W. ¼ of N. E ¼ S. 21, T. 14, R. 2 W.*

Roof; shaly clay.
COAL, 13½ in.
Shaly Clay.

(68) *On the North Bank of Lick Creek in the N. E. ¼ of S. E. ¼ of S. 32, T. 14, R. 2 W.*

Roof; clay and sand, debris.
COAL, 10 in.
Clay, 7 in.
COAL, 5 in.
Fire clay.

Supposed *New Castle Seam.*

(69) *On the West Bank, 25 ft. above Low Water Level, ⅛ mile below the Junction of Gurley and Self Creeks, or in the S. E. ¼ of N. W. ¼ of S. 21, T. 14, R. 2 W.*

Roof; clay, shale, debris.
COAL, 15 in.
Fire clay.

(70) *On the East Bank of Self's Creek, 300 ft. South of Country Road, in the N. W. ¼ of S. E. ¼ of S. 28, T. 14, R. 2 W.*

Roof; shale.
COAL, 5 in.
Shale ; hard, with impressions of coal plants.

(71) *On East Bank of Self's Creek, ½ mile above the Crossing of Morris Station and Village Springs Road*; *or in the N. E. ¼ of N. E. ¼ of S. 33, T. 14, R. 2 W.*

Roof; shaly clay.
COAL, 6 in.
Slate; hard.

(72) *On West Side of Ravine 100 ft. North of Country Road and ¼ mile West of Junction of Gurley and Self Creeks, or in the N. E. ¼ of S. W. ¼ of S. 21, T. 14, R.* 2 *W.*

Roof; shale.
COAL, shale, 3 in.
COAL, 16 in.
Fire clay.

(73) *On the West Bank of Self's Creek, about 15 feet above Low Water Level, 300 feet North of Country Road and ½ mile above the Junction of Self and Gurley Creeks, or in the N. W. ¼ of N. E. ¼ of S. 28, T. 14, R. 2 W.*

Roof; shale.
COAL, 23 in.
Fire clay.

(74) *On a Small Branch ¼ mile South of where it runs into Turkey Creek, or in the S. W. ¼ of N. W. ¼ of S 7, T. 15, R. 2 W.*

Roof; shale.
BLACK BAND, 6 in.
COAL, 22 in.
Shale, hard floor.

(75) *On a Small Branch ¼ mile South of where it runs into Turkey Creek, or in the S. W. ¼ of N. W. ¼ of S. 7, T 15, R. 2 W.*

Roof; sandstone.
COAL, 2⅛ in.
Clay, 13⅛ in.
COAL, 8 in.
COAL, shaly, 3⅛ in.
Fire Clay; floor.

(76) *In Ravine 150 yards North of Turkey Creek and 100 yards below Test Pit (75), or in the S. W. ¼ of N. W. ¼ of S. 7. T. 15, R. 2 W.*

Roof; shale.
COAL, 9 in.
Fire Clay; floor.

(77) *On the North Bank of Gurley's Creek in the S. W. ¼ of N. E. ¼ of S. 29, T. 14, R. 1 W.*

Roof; sandstone.
COAL; the lower part shaly, 24 in.

Supposed *Black Creek Seam.*

(78) *On the South Bank of Gurley's Creek in the S. W. ¼ of N. E. ¼ of S. 29, T. 14, R. 1 W.*

Roof; sandstone.
COAL; inferior, 15 in.
Shale.

(79) *On the North Bank of Gurley's Creek in the N. W. ¼ of N. E. ¼ of S 29, T. 14, R. 1 W.*

Roof; IRON STONE, fossiliferous.
COAL; soft, 12 in.
Shale.

(80) *On the North Bank of Gurley's Creek in the S. W. ¼ of N. E. ¼ of S. 29. T. 14, R. 1 W.*

Roof; IRON STONE, fossiliferous.
COAL; inferior, 14 in.
Shale.

(*81*) *On the North Bank of Gurley's Creek in the S. W. ¼ of S. W. ¼ of S. 20, T. 14, R. 1 W.*

Roof; sandstone.
COAL; good, 8 in.
Shale; bituminous, 11 in.

(*82*) *On the South Bank of Gurley's Creek in the N. E. ¼ of N. E. ¼ of S. 30, T. 14, R. 1 W.*

Roof; sandstone.
COAL, 3¼ in.
Shale; bituminous 11 in.
Shale, 24 in.
COAL, 9 in.
Shale.

Supposed *Jefferson Seam.*

(*83*) *On the South Bank of Gurley's Creek in the N. E. ¼ of N. W. ¼ of S. 30, T. 14, R. 1 W.*

Roof; shale.
COAL. 13⅛ in.
Shale.

(*84*) *On a Small Branch ¼ mile from North Bank of Gurley's Creek, or in the N. E. ¼ of S. E. ¼ of S. 24, T. 14, R. 2 W.*

Roof; shale.
COAL, 32 in.
Shale.
Top Seam.

(*85*) *On a Small Branch ¼ mile from North Bank of Gurley's Creek, or in the N. E. ¼ of S. E. ¼ of S. 24, T. 14, R. 2 W.*

Roof; shale.
COAL, 33 in.
Shale; bituminous, 6 in.
COAL, 22¼ in.
Sandstone.

This pit is 25 feet lower than pit (84); the coal has no luster and gives a red ash. See (104).

(86) *On the South Banks of Gurley's Creek in the N. E. ¼ of N. W. ¼ of S. 25, T. 14, R. 2 W.*

Roof; clay, drift.
COAL, 14 in.
Shale.

Out-crop on summit of hill.

(87) *On the South Bank of Gurley's Creek, about 12 feet below Pit (86), in the N. E. ¼ of N. W. ¼. of S. 25, T. 14, R. 2 W.*

Roof; shale.
COAL, 26 in
Shale.

(88) *On the South Bank of Gurley's Creek, about 15 feet below Pit (87), in the N. E. ¼ of N. W. ¼ of S. 25, T. 14, R. 2 W.*

Roof; shale.
COAL, 4 in.
Shale, 12 in.
COAL, 3½ in.
Shale.

(89) *On the South Bank of Gurley's Creek in the N. W. ¼ of N. E. ¼ of S. 25, T. 14, R. 2 W.*

Roof; shale.
COAL, 18 in.
Shale.

Supposed to be of same seam as (84).

(90) *On Small Branch about ½ mile South of Gurley's Creek, or in the S. E. ¼ of N. W. ¼ of S. 25, T. 14, R. 2 W.*

Roof; shale.
COAL, 24 in.
Shale.

(91) *In the N. W. ¼ of N. E. ¼ of S. 25, T. 14, R. 2 W., near Mr. J. McComb's Residence:*

Roof; drift.
COAL, 66 in.
Shale; bituminous, 6 in.
Sandstone.

This coal has no bedded roof and doubtless some of it has been washed away. There are indications of shale near the center of the coal and the bottom portion has sulphur (pyrites) in it. This is evidently of the same seam as (85).

(92) *One mile South of Gurley's Creek, on Hill Side in the S. E. ¼ of S. E. ¼ of S. 25, T. 14, R. 2 W.*

Roof; shale.
COAL, 8 in.
Shale.

(93) *On a Tributary of Self's or Dry Creek, one mile North of Gurley's Creek, or in the N. W. ¼ of S. 18, T. 14, R. 1 W.*

Roof; shale.
COAL, 31½ in.
Shale.

(94) *On the South Bank of Gurley's Creek about ¼ mile below Terry's Gin, or in the N. W. ¼ of S. W. ¼ of S. 25, T. 14, R. 2 W.*

Roof; shale.
COAL, 14 in.
Shale, 5 in.
COAL, 8 in.
Shale.

(95) *On the North Bank of Gurley's Creek in the N. E. ¼ of S. W. ¼ of S. 24, T. 14, R. 2 W.*

Roof; shale.
COAL, 30 in.
Shale.

Supposed *Black Creek Seam.*

(96) *On the North Bank of Gurley's Creek, 30 feet above Pit (95), in the N. E. ¼ of S. W. ¼ of S. 24, T. 14, R. 2 W.*

Roof; sandstone.
COAL, 4 in.
Shale, 11 in.
COAL, 9 in.
Shale.

(97) *On the North Side of Gurley's Creek, about 100 yards East of Smith's Mill, in the S. W. ¼ of N. W. ¼ of S. 24, T. 14, R. 2 W.*

Roof; shale.
COAL, 2½ in.
Shale, 3 in.
COAL, 14 in.
Shale.

(98) *On a Small Branch, ½ mile South of Gurley's Creek, or in the N. W. ¼ of S. W. ¼ of S. 24, T. 14, R. 2 W.*

Roof; drift.
COAL, 14½ in.
Shale; bituminous, 7 in.
COAL, 3 in.
Shale.

(99) *On the North Bank of Gurley's Creek in the N. E. ¼ of N. E. ¼ of S. 23, T. 14, R. 2 W.*

Roof; shale.
COAL, 2 in.
Shale, 1½ in.
COAL, 11½ in.
Shale.

(100) *At Low Water Level on the North Bank of Gurley's Creek in the N. E. ¼ of N. E. ¼ of S. 23, T. 14, R. 2 W.*

Roof; shale.
Shale; bituminous, 4 in.
COAL, 16½ in.
Shale.

Supposed *Black Creek Seam.*

(*101*) *On the North Bank of Gurley's Creek, 30 feet above Pit 100, in the N. E. ¼ of N. E. ¼ of S. 23, T. 14, R. 2 W.*

Roof; shale.
Shale; bituminous, 18 in.
COAL, 13 in.
Shale, 11 in.
COAL, 6 in.
Shale; floor.

(*102*) *On the North Side of Gurley's Creek, about 100 yards from Terry's Gin, in the S. W. ¼ of S. E. ¼ of S. 24, T. 14, R. 2 W.*

Roof; shale, evidently disturbed.
COAL, 24 in.
Shale.

(*103*) *On the North Side of Gurley's Creek, 150 yards below Terry's Gin and about 20 feet under Pit (88), in the N. E. ¼ of N. W. ¼ of S. 25, T. 14, R. 2 W.*

Roof; shale.
COAL, 18 in.
Shale; blue and soft.

Dip 2° 3′ to N. 45° W.

(*104*) *On Small Branch ½ mile from Gurley's Creek, or in the N. E. ¼ of S. E. ¼ of S. 24, T. 14, R. 2 W.*

Roof; shale.
COAL, 33 in.
Shale, 3½ in.
COAL, 6 in.
Shale, 3 in.
COAL, 12 in.
Sandstone; floor.

This is a section of the same pit as (85) drifted into about 10 feet further. It is the supposed *New Castle Seam.* The dip is 2° 30′ to N. 85 W.

(*105*) *Near Mr. James McCombs' residence and 10 yards from Pit* (*91*), *in the N. W.* ¼ *of N. E.* ¼ *of S. 25, T. 14, R. 2 W.*

Roof; drift.
COAL, 41 in.
Shale, 2 in.
COAL, 7 in.
Shale, 2 in,
COAL, 20 in.
Sandstone; floor.

Supposed *New Castle Seam.*

(*106*) *On a Small Branch* ½ *mile South of Self's Creek, in the N. E.* ¼ *of S. E.* ¼ *of S. 33, T. 14, R. 2 W.*

Roof; shale.
COAL, *clay*, 3 in.
Shale, 18 in.
COAL, 10 in.
Fire Clay, 1½ in.
COAL, 2 in.
Shale; floor.

Supposed *New Castle Seam.*

(*107*) *On a Small Branch* ¾ *mile South of Self's Creek, in the N. W.* ¼ *of N. E.* ¼ *of S. 4, T. 15, R. 2 W.*

Roof; shale.
COAL, 12 in.
Fire Clay, 1 in.
COAL, 38 in.
Shale, floor.

Dip, easterly 3° 10′.

(*108*) *In a Ravine extending down to a Branch of Self's Creek,* ½ *mile North-east of the Creek, or in the S. W.* ¼ *of S. E.* ¼ *of S. 23, T. 14, R. 2 W.*

Roof; shale.
COAL, 10 in.
Clay, 1½ in.
COAL, 5 in.
Sandstone; floor.

(109) *On an E. and W. Branch of Self's Creek, 200 feet from the Branch and ¼ mile from its mouth and 75 feet from an Old House, or in the S. E. ¼ of S. E. ¼ of S. 34, T. 14, R. 2 W.*

Roof; shaly clay.
COAL, 9 in.
Fire Clay; floor.

This pit is near summit of hill.

(110) *On Side of a Branch ¼ mile East of Self's Creek, or in the S. E. ¼ of S. E. ¼ of S. 34, T. 14, R. 2 W.*

Roof; shale.
COAL, 9 in.
Fire Clay; floor.

(111) *On the Side of the Morris Station and Village Springs Road, ¼ mile West of Mr. J. P. Hughes' Residence, or in the S. W. ¼ of S. W. ¼ of S. 27, T. 14, R. 2 W.*

Roof; Clay.
COAL, 2½ in.
Clay; shaly, 18 in.
COAL, 3 in.
Fire Clay; floor.

(112) *On Morris Station and Village Springs Road, 200 yards West of Mr. J. P. Hughes' Residence, or in the S. W. ¼ of S. W. ¼ of S. 27, T. 14, R. 2 W.*

Roof; drift.
COAL, 10 in.
Fire Clay; floor.

(113) *In the S. E. ¼ of S. E. ¼ of S. 33. T. 14, R. 2 W.*

Roof; clay.
COAL, 9 in.
Shale, clay, 3 in.
COAL, 8 in.
Shale, 7¼ in.
COAL, 7 in.
Clay, 3¾ in.
COAL, 15½ in.
Shaly clay; floor.

The coal of this seam, like others, has in it thin layers of *mineral charcoal;* it crumbles on handling, and has a dull color, without luster, and gives a white ash. Supposed *New Castle Seam.* The dip is 2° 10′ to East.

(114) On West Bank, 75 feet above Low Water Level, of a Small Branch of Self's Creek, or in the S. E. ¼ of S. E. ¼ of S. 7, T. 15, R. 1 W.

Roof; shaly clay.
COAL, 8 in.
Fire clay; floor.

(115) On the East Bank of Small Branch of Self's Creek ¼ mile higher up the Branch than Pit (114), or in the N. E. ¼ of S. E. ¼ of S. 7, T. 15, R. 1 W.

Roof; shale.
COAL, *sandstone;* mixed, 9 in.
Shale; yellow, floor.

(116) On Prong of North Creek, 30 feet higher topographically than Pit (3), in the S. W. ¼ of S. W. ¼ of S. 26, T. 15, R. 2 W.

Roof; clay.
COAL, *clay,* 11½ in.
COAL, 3½ in.
Clay, 5 in.
COAL, *clay,* 39½ in.
COAL, 6 in.
COAL, *clay,* 1½ in.
COAL, 15½ in.
COAL, *clay,* 8 in.

This is thought to be the *New Castle Seam* and the same as Pit (3).

(117) On the North Bank of Turkey Creek from ¼ to ½ mile above Glenn's Mill, or in the S. W. ¼ of S. E. ¼ of S. 14, T. 15, R. 2 W.

Roof; drift.
Clay; BLACK BAND; mixed, 66 in.
COAL, 6½ in.
Shale, 2½ in.
COAL, 6 in.
Shale; floor.

This pit was drifted in about 15 feet. Supposed *New Castle Seam.* Dip, 5° 30″ to S. W.

(118) On Beech Branch about 230 yards above the Falls and Pit (48), or in the N. W. ¼ of N. W. ¼ of S. 8, T. 15, R. 2 W.

A test pit dug under a small seam of *black band* and carried down to the level of seam in pit (58) exposed no sign of *black band.* The *black band* of pit (58) was exposed and traced to fault. In pit (58) the dip was 1° 30′ to S. 45° E. and 12 feet to the north it was 9° 20′ N. W.

(119) On Jasper Road in the S. E. ¼ of S. E. ¼ of S. 9. T. 15, R. 2 W.

A surface seam of a few inches in thickness of *Spathic Iron Ore.* It also shows about ¼ mile farther to the east. It is of no value.

(120) On the South-west Bank of a Small Branch of Turkey Creek about ¼ mile from the creek, or in the N. W. ¼ of S. W. ¼ of S. 24 T. 15, R. 2 W.

Roof; hard curly shale.
COAL, 33 in.
Shale; floor.

Supposed *Pierce or Warrior Seam.*

(121) On the South Bank of Turkey Creek ¼ mile below Pit (120) and 30 feet above Pit (8), in the S. W. ¼ of N. E. ¼ of S. 24, T. 5, R. 2 W.

Roof; shale.
BLACK BAND, 24 in.
COAL, 6 in.
Clay, 1 in.
COAL, 5 in.
Clay, 13 in.
COAL, 3 in.
Clay, 1½ in.
COAL, 5½ in.
Clay, ½ in.
COAL, 7 in.
COAL, *clay,* 4 in.
Shale; floor.

Supposed *New Castle Seam.*

(122) *In Bluff on the South Bank of Turkey Creek, 30 feet below Pit (121), in the S. W. ¼ of N. E. ¼ of S. 24, T. 15, R. 2 W.*

Roof; shale.
COAL, *clay,* 12 in.
COAL, 6½ in.
Clay, 3½ in.
COAL, 15 in.
Fire clay; floor.

Supposed *Jefferson Seam.* This pit is the same as pit (8) re-cut.

(123) *On the South Bank of Turkey Creek, at Low Water Level, about 30 feet below Pit (122), in the S. W. ¼ of N. E. ¼ of S. 24, T. 15, R. 2 W.*

Roof; hard curly shale.
COAL, 26½ in.
Fire clay; floor.

This is pit (9) re-cut. Supposed *Black Creek Seam* or *Hanby Old Mill Seam* of pit (6).

(124) *Near Mr. John Hudson's Residence, on the South Side of Self's Creek, some 400 feet from the Creek, or in the N. E. ¼ of N. E. ¼ of S. 18, T. 15, R. 1 W.*

Roof; clay.
COAL, 12 in.
Clay; floor.

(125) *On the South Side of Self's Creek, on a Small Branch in the S. W. ¼ of N. W. ¼ of S. 18, T. 15, R. 1 W.*

Roof; shale.
COAL, 14 in.
Shale; floor.

(126) *On South Side of Self's Creek, on a Small Branch in the N. W. ¼ of N. W. ¼ of S. 18, T. 15, R. 1 W.*

Roof; shale.
COAL, 1 in.
Shale; floor, 39 in.
BLACK BAND, 8 in.
Shale; floor.

(*127*) *In R. R. Cut in the N. W. ¼ of N. W. ¼ of S. 18, T. 15, R. 1 W.*

Roof; shale.
COAL, 3 in.
Shale; floor.

(*128*) *Out-crops on the South Bank of Flat Creek in the S. E. ¼ of S. E. ¼ of S. 18, T. 15, R. 2 W.*

Roof; shale.
COAL, shaly, 6 in.
COAL, 13 in.
Slate; streak.
COAL, 10 in.
Slate; streak.
COAL, 6 in.
Shale; floor.

Supposed *New Castle Seam.* Dip 5° 20′ E.

(*129*) *On the Jasper Road and on the South Bank of Turkey Creek in the N. W. ¼ of N. E. ¼ of S. 25, T. 15, R. 2 W.*

Roof; shale.
COAL, 15 in.
Shale; floor.

Dip, 11° 20′ to N. 45° W.

(*130*) *On South Bank of South Prong of Dry Creek in the N. E. ¼ of N. W. ¼ of S. 17, T. 14, R. 1 W.*

Roof; shale.
COAL, 1 in.
Shale; floor.

(*131*) *On South Bank of South Prong of Dry Creek about 450 feet below Pit (130) or in the N. E. ¼ of N. W. ¼ of S. 17, T. 14, R. 1 W.*

Roof; shale.
COAL, 3 in.
Shale; floor.

(*132*) *On Small Branch ¼ mile South of South Prong of Dry Creek, or in the N. W. ¼ of N. E. ¼ of S. 17, T. 14, R. 1 W.*

Roof; shale.
COAL, 12 in.
Shale; floor.

(133) On South Prong about ¼ mile South of Dry Creek, or in the N. E. ¼ of N. W. ¼ of S. 17, T. 14, R. 1 W.

Roof; shale.
COAL, 8 in.
Shale; floor.

(134) On the North Bank of North Prong of Dry Creek in the N. E. ¼ of S. 8, T. 14, R. 1 W.

Roof; shale.
COAL, 12½ in.
Shale; floor.

(135) On the North Bank of North Prong of Dry Creek in the N. E. ¼ of S. 8, T. 14, R. 1 W.

Roof; shale.
COAL, 5½ in.
Shale; floor.

(136) On the South Bank of North Prong of Dry Creek in the S. W. ¼ of N. W. ¼ of S. 8, T. 14, R. 1 W.

Roof; shale.
COAL, 6 in.
Shale; floor.

(137) About ¼ mile north of Dry Creek, in the N. W. ¼ of N. E. ¼ of S. 12, T. 14, R. 2 W.

Roof; shale.
COAL, *clay*, 8 in.
Shale, 5 in.
COAL, shale, 8 in.
COAL, 6 in.
COAL; streak, 1½ in.
COAL, 53½ in.
Shale; bituminous, 10 in.
COAL, 21 in.
BLACK BAND, 8 in.
Sandstone; floor.

Supposed *New Castle Seam*. Dip, 30° 20′ to N. 30° E. See (143).

(*138*) *North of Dry Creek ½ mile in the N. E. ¼ of N. W. ¼ of S. 12, T. 14, R. 2 W.*

> COAL, 1 in.
> *Clay*, 1½ in.
> COAL, 2½ in.
> *Clay*, 1 in.
> COAL, 36 in.
> *Shale*, floor.

Dip 1° to E.

(*139*) *About 900 feet North of Pit* (*137*), *in the N. W. ¼ of N. E. ¼ of S. 12, T. 14, R. 2 W.*

> *Roof;* clay.
> COAL, *clay*, 6½ in.
> *Shale*, 3½ in.
> COAL, 5 in.
> *Clay;* shaly, 2½ in.
> COAL, 2½ in.
> *Shale*, streak.
> COAL, 26 in.
> *Shale;* floor.

Supposed *New Castle Seam*. Dip, 3° to N. 6 ,° W.

(*140*) *About 600 feet North-west of Pit* (*137*) *and 50 feet higher, in the N. W. ¼ of N. E. ¼ of S. 12, T. 14, R. 2 W.*

> *Roof;* drift.
> COAL, 12 in.
> *Shale;* floor.

This seam has evidently been disturbed. The dip varies.

(*141*) *About 300 yards North of Blount Springs Road, on a Small Tributary to Long Branch, or in the N. E. ¼ of N. E. ¼ of S. 2, T. 14, R. 2 W.*

> *Roof:* shale.
> COAL, *shale ;* the shale in pieces, 8 in.
> COAL, 23 in.
> *Shale ;* floor.

This coal has been used for years by black-smiths from Blount Springs, Blountsville, etc.

(*142*) *About 200 yards South of Blount Springs Road, opposite Dallas Morton's Residence, or in the N. E. ¼ of N. E. ¼ of S. 2, T. 14, R. 2 W.*

Roof; shale.
COAL, 5 in.
Fire clay.

This pit is some 20 feet barometrically higher than pit (141).

(*143*) *Same Pit as (137) drifted into to solid cover, in the N. W. ¼ of N. E. ¼ of S. 12, T. 14, R. 2 W.*

Roof; shale.
COAL, 5 in.
COAL; shaly, 1¼ in.
COAL, 3 in.
Slate; streak.
COAL, 13 in.
Slate; streak.
COAL, 3 in.
COAL; shaly, 1½ in.
COAL, 33 in.
Shale; bituminous, 10 in.
COAL, 20 in.
BLACK BAND, 7 in.
Slate; hard.

This coal has no luster and is partly curly and laminated, add has near its bottom small fragments of pyrites. The supposed *New Castle Seam.*

(*144*) *At the Head of a Small Branch, ½ mile South of Long Branch and ¼ mile North of Blount Springs Road, or in the S. W. ¼ of N. W. ¼ of S. 6, T. 14, R. 1 W.*

Roof; shale.
COAL; shaly, 7 in.
Shale, 6 in.
COAL, 23 in.
Shale, floor.

Perhaps *Jefferson Seam.* Dip, 4° 30' N. E.

(*145*) *About 1,000 feet North of the Blountsville Road, in a Ravine extending down to Long Branch, or in the S. E.* ¼ *of N. E.* ¼ *of S. 6, T. 14, R. 1 W.*

Roof; shale.
COAL; shaly, 9½ in.
Shale, 4½ in.
COAL, 3 in.
Clay, 1 in.
COAL, 26 in.
Shale; floor.

Supposed *New Castle Seam.*

(*146*) *On the Divide between Gurley's and Dry Creek, in the S. E.* ¼ *of N. W.* ¼ *of S. 13, T. 14, R. 2 W.*

Roof; shale.
COAL, 9 in.
Shale, 10 in.
COAL, 18 in.
Shale; floor.

(*147*) *On a Small Branch of Dry Creek, in the N. E.* ¼ *of S. W.* ¼ *of S. 18, T. 14, R. 1 W.*

Roof; sandstone.
COAL, 46½ in.
Shale, 16 in.
COAL, 13 in.
BLACK BAND, 17½ in.

This is of the same seam as pits (85) and (91), and is 20 feet barometrically above (93). It is mixed with *black band ore* and pieces of iron sulphide. Supposed *New Castle Seam.*

(*148*) *On the South Side of Blount Springs Road, and on the North Bank of Dry Creek about 600 feet from its Mouth or the Warrior River, or in the N. E.* ¼ *of N. W.* ¼ *of S. 10, T. 14, R. 2 W.*

Roof; shale.
COAL; shaly, 11 in.
COAL, 28 in.
Shale; floor.

(149) *On the North Side of Blount Springs Road, 150 feet East of Pit (149) and 30 feet higher, in the N. E. ¼ of N. W. ¼ of S. 10, T. 14, R. 2 W.*

Roof; drift.
COAL, 17 in.
Shale, floor.

This pit is near the top of the divide between Long Branch and Dry Creek.

(150) *In Bluff on the South Bank of Dry Creek in the N. W. ¼ of N. W. ¼ of S. 11, T. 14, R. 2 W.*

Roof; shale.
COAL; shaly, 7½ in.
COAL, 24 in.
Shale ; floor.

(151) *About 550 feet North of Dry Creek, in the S. W. ¼ of N. E. ¼ of S. 11, T. 14, R. 2 W.*

Roof; shale.
COAL; shaly, 5½ in.
Shale, 4 in.
COAL; shaly, 11 in.
Shale, 22 in.
COAL, 26 in.
Shale; floor.

This coal is firm and laminated. Supposed *New Castle Seam.*

(152) *About ¾ mile West of the Blountsville Road, on the South side of Long Branch in the N. E. ¼ of S. 5, T. 14, R. 1 W.*

Roof; shale.
COAL, 2 in.
Clay, 2 in.
COAL, shaly, 5 in.
Clay, 9 in.
COAL, *clay,* 2 in.
Clay, 2 in.
COAL, 26½ in.

This pit is near the top of a high ridge. Supposed *New Castle Seam.*

(153) *About ¼ mile West of Pit (152), in the S. N. ¼ of S. 5, T. 14, R. 1 W.*

Roof; drift.
COAL, 18 in.
Shale; floor.

This coal is near the top of the hill and has been badly weathered.

(154) *About 150 yards North-west of Reede's residence, in the N. W. ¼ of N. W. ¼ of S. 4 T. 14, R. 1 W.*

Roof; shale.
COAL, 3 in
Shale; floor.

Dip, 9° 40′ to N. 25° W.

(155) *On a Small Branch, 750 yards North-west of Dry Creek, in the S. W. ¼ of S. 4, T. 14, R. 1 W.*

Roof; slate.
COAL, 6 in.
Shale; floor.

Dip, 9° 10′ to N. 45° W.

(156) *South of Dry Creek about ½ mile, in the N. E. ¼ of S. 20, T. 14, R. 1 W.*

Roof; shale.
COAL, 14 in.
Shale; floor.

This coal is bony. Dip, 10° 20′ to N. 45° W.

(157) *South of Pack-saddle Creek ¼ mile and North of Warrior Road 500 feet, in the N. W. ¼ of S. E. ¼ of S. 30, T. 13, R. 1 W.*

Roof; clay.
COAL, *clay*, 3 in.
Clay, 3 in.
COAL, 29 in.
Clay; floor.

This coal has a *face and butt structure*, and is hard and bright. Supposed *Jefferson Seam.*

(158) *On the South Bank of Pack-saddle or White's Creek, ¼ mile from its Mouth or the Warrior River, or in the S. W. ¼ of N. W. ¼ of S. 30, T. 13, R. 1 W.*

Roof; slate.
COAL, 7 in.
Slate; floor.

This coal has a *face and butt structure*, and is hard and bright.

(159) *About ¼ mile South of Pack-saddle Creek and 500 feet North of Warrior Road, in the S. W. ¼ of S. E. ¼ of S. 25, T. 13, R. 2 W.*

Roof; drift.
COAL, 2½ in.
COAL, *clay*, 6 in.
COAL, 28 in.
Shale; floor.

This coal is badly weathered and broken up.

(160) *About ¾ mile East of the Warrior River and ¼ mile South of Pack-saddle Creek, in the N. W. ¼ of N. W. ¼ of S 25, T. 13, R. 2 W.*

Roof; shale.
COAL, *clay*, 9½ in.
COAL, 28 in.
Shale; floor.

This coal is bright and hard, and breaks up in cubes.

(161) *South-west of Pit (160) 700 feet, in the N. W. ¼ of N. W. ¼ of S. 25. T. 13, R. 2 W.*

Roof; shale.
COAL, *clay*, 12 in.
COAL, 25 in.
Shale; floor.

This coal has a *face and butt structure*, and is hard and bright.

(*162*) *About ¼ mile West of Pit (161) and 75 feet lower, in the S. W. ¼ of S. W. ¼ of S. 26, T. 13, R. 2 W.*

Roof; shale.
COAL, shaly, 3 in.
Shale, 2 in.
COAL, 3 in.
Shale; floor.

(*162½*) *About 50 feet South of Warrior Station Road ½ mile West of crossing of Pack-saddle Creek, or in the S. W. ¼ of S. E. ¼ of S. 30, T. 13, R. 1 W.*

Roof; drift.
Clay.
COAL, *clay*, 10½ in.
COAL, 34 in.
Clay; floor.

This coal is badly weathered and broken up; the pieces have a *face and butt structure.* Dip, 1° to N.

(*163*) *Near Old School House, in a ravine 300 yards West of Township Road, in the N. E. ¼ of S. 31, T. 13, R. 1 W.*

Roof; drift.
Clay.
COAL, *clay*, 10 in.
COAL, 26 in.
Clay; floor.

This pit is within 20 feet of top of hill. The weather worn pieces show a *face and butt structure.*

(*164*) *About 300 feet North of Old School House and 100 feet East of Country Road, in the N. E. ¼ of S. 31, T. 13, R. 1 W.*

Roof; clay, sandstone.
COAL, 9 in.
Clay; floor.

This coal has been disturbed or broken up.

(165) *On side of Country Road in the S. E. ¼ of S. 31, T. 13, R. 1 W.*

Roof; clay.
COAL, *clay*, 8 in.
COAL, 14 in.
Clay, floor.

This coal is badly weathered.

(166) *Near East Bank of Warrior River, on side of Settlement Road, in the N. W. ¼ of S. 17, T. 13, R. 1 W.*

Roof; drift.
COAL, 4½ in.
Clay, shaly.

(167) *In Bluff on the South Bank of the Warrior River in the N. W. ¼ of S. 17, T. 13, R. 1 W.*

Roof; shale.
COAL, 8½ in.
Shale; floor.

(168) *On the East Bank of Hall Mark Creek in the S. W. ¼ of S. 16, T. 13, R.* I *W.*

Roof; slate.
COAL, 5½ in.
Slate.

This coal is hard and bright.

(169) *On the South side of Hall Mark Creek in the S W. ¼ of S.* 17, *T. 13, R.* 1 *W.*

Roof; shale.
COAL, 6¾ in.
Clay, shaly.

(170) *On the South Bank of Hall Mark Creek 150 feet from its mouth or the Warrior River, in the S. W. ¼ of S. W. ¼ of S. 17, T. 13, R. 1 W.*

Roof; slate.
COAL, 7½ in.
Clay; shaly.

This coal is hard and bright.

(171) *On the North Bank of Pack-saddle or White's Creek, in the N. E. ¼ of N. W. ¼ of S. 28, T. 13, R. 1 W.*

Roof; slate.
COAL, 5½ in.
Slate; floor.

(172) *Under Bluff on the South Bank of Pack-saddle or White's Creek in the S. E. ¼ of N. W. ¼ of S. 28, T. 13, R. 1 W.*

Roof; slate.
COAL, 4 in.
Slate.

(173) *In Bluff of Locust Fork of Little Warrior River, South-east of Road and about 300 feet from Pine Bluff Church, or in the S. E. ¼ of S. W. ¼ of S. 14, T. 13, R. 1 W.*

Roof; slate.
COAL, 2 in.
Slate.

(174) *Some 900 feet West of the Blountsville Road on a Small Branch in the S. W. ¼ of S. E. ¼ of S. 4, T. 13, R. 1 W.*

Roof; shale.
COAL, 1½ in.
Shale; floor.

(175) *East of Locust Fork of Little Warrior about ¼ mile in S. W. ¼ of N. W. ¼ of S. 8. T. 13, R. 1 W.*

Roof; shale.
COAL, 7 in.
Shale; bituminous, floor.

(176) *Under a Bluff 75 feet South of Locust Fork of Little Warrior River in the S. W. ¼ of N. E. ¼ of S. 4, T. 13, R. 1 W.*

Roof; slate.
COAL, 5 in.
Slate; floor.

This coal is hard and bright and has a *face and butt structure.*

(177) *Under a Bluff on a Branch in the S. E. ¼ of S. 5, T. 13, R. 1 W.*

Roof; slate.
COAL, 7½ in.
Slate; floor.

(178) *On a Small Branch, ¼ mile of Little Warrior River and 150 feet South of Plantation Road, in the N. E. ¼ of S. E. ¼ of S. 4, T. 13, R. 1 W.*

Roof; slate.
BLACK BAND, 15 in.
Slate; floor.

(179) *South of the Warrior River ¼ mile on a Small Branch in the S. E. ¼ of N. E. ¼ of S. 4, T. 13, R. 1 W.*

Roof; slate.
BLACK BAND, 13 in.
Slate; floor.

This pit is about 250 feet down the branch from pit (178).

(180) *Some 400 feet South of Mr. J. C. Glasscock's Residence, in a well at the Shingle Mill in the N. E. ¼ of S. W. ¼ of S. 11, T. 13, R. 1 W.*

Roof; slate.
COAL, 3½ in.
Slate; floor.

(181) *Some 600 feet South of Little Warrior River under a Bluff on a Branch in the S. E. ¼ of N. E. ¼ of S. 11, T. 13, R. 1 W.*

Roof; slate.
COAL, 6 in.
Slate.

This coal is hard and bright.

(182) *On the North Bank of Pack-saddle or White's Creek, in the N. W. ¼ of S. W. ¼ of S. 27, T. 13, R. 1 W.*

Roof; slate.
COAL, 6 in.
COAL; shaly, 2½ in.

This coal is bright and hard,

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(*183*) *On the North Bank of Pack-saddle or White's Creek 15 feet above Low Water Level in the N. W. ¼ of S. E. ¼ of S. 28, T. 13, R. 1 W.*

Roof; slate.
COAL; shaly, 6 in.
COAL, 4 in.

(*184*) *On the East Bank of Dry Creek about ¾ mile from its Mouth or the Warrior River, or in the N. E. ¼ of S. 26, T. 12. R. 1 W.*

Roof; slate.
COAL, 4 in.
Slate; floor.

This coal is hard, bright and curly.

(*185*) *On the West Bank of Dry Creek ¼ mile below the Ford of a Country Road and ¼ mile from its mouth or the Warrior River, or in the S. E. ¼ of S. 34, T. 12, R. 1 W.*

Roof; slate.
COAL; bony, 5 in.
Slate; floor.

(*186*) *About 400 feet East of the Blountsville Road on a Small Branch at the Dripping Spring in the S. E. ¼ of N. E. ¼ of S 25, T. 12, R. 1 W.*

Roof; slate.
COAL, 2 in.
COAL, *slate*, 4½ in.
Slate; floor.

This coal is hard and glossy.

(*187*) *One Mile East of Crossing of Dry Creek by Blountsville Road and 300 feet South of this Creek, near the Top of the Mountain in the N. E. ¼ of S. E. ¼ of S. 19, T. 12, R. 1 E.*

Roof; shale.
COAL, 6½ in.
Shale, clay; floor.

(187½) On a Branch about ¼ mile from its Mouth or from Dry Creek, or in the S. W. ¼ of S. E ¼ of S. 19, T. 12, R. 1 E.

Roof; clay and shale.
COAL, 6 in.
Slate; floor.

This coal is hard and glossy.

(188) About 150 feet higher up the Branch than Pit (187), in the S. W. ¼ of S. E. ¼ of S. 19, T. 12, R. 1 E.

Roof; clay.
COAL, 2 in.
Clay, slate; floor.

This coal is very soft and impure.

(189) About 800 feet South of the Chepultepec Road under a Small Bluff at a Dripping Spring in the N. E. ¼ of N. E. ¼ of S. 30, T. 12, R. 1 E.

Roof; slate.
COAL, 4 in.
Slate, floor.

This coal is hard and bright.

(190) At the Spring 300 feet South of Mr. Sutherland's Residence, known as the Holly Place, in the S. W. ¼ of N. W. ¼ of S 29, T. 12, R. 1 E.

Roof; shale.
COAL, 12 in.
Clay, 2½ in.
COAL, 1½ in.
Sandstone; floor.

This coal is hard and has a good luster.

(191) About ¼ mile from Miss E. Walker's Residence and 20 feet East of Little Warrior River in the S. W. ¼ of S. 28, T. 12, R. 1 E.

Roof; drift.
COAL, 8½ in.
Slate; floor.

This coal is hard and curly, and has in it traces of iron pyrites.

(192) *About ¼ mile South of Mr. S. D. Reese's Residence in a Small Gully in the N. W. ¼ of S. W. ¼ of S. 20, T. 12, R. 1 E.*

Roof; shale.
COAL, 5 in.
Shale.

This coal is hard and bright, and has a *face and butt structure.*

(193) *About ½ Mile North of Mr. S. D. Reese's Residence on a Small Branch in the S. W. ¼ of N. W. ¼ of S. 20, T. 12, R. 1 E.*

Roof; shale.
COAL, 2 in.
Clay, floor.

(194) *About 500 feet South east of Dry Creek in a Gully on the Mountain in the S. W. ¼ of S. E. ¼ of S. 17, T. 12, R. 1 E.*

Roof; shale.
COAL, 11 in.
Sandstone; floor.

This coal is weathered and soft.

(195) *North of Little Warrior River about ½ mile, in the S W. ¼ of N. E. ¼ of S. 6, T. 13, R. 1 E.*

Roof; shale.
COAL, 10 in.
Shale, 4 in.

This coal is hard and bright.

(196) *On West Bank of Small Branch of Little Warrior River, in the S. W. ¼ of N. E. ¼ of S 5. T. 13, R. 1 E.*

Roof; shale.
COAL, 9 in.
Shale, 2 in.
COAL, 12 in.
Shale; floor.

(197) *About 800 feet West of Little Warrior River, on the Blountsville Road in the S. W. ¼ of N. E. ¼ of S. 1, T. 13, R. 1 W.*

Roof; shale.
COAL, 6 in.
Shale, floor.

(*198*) *In the N. E. ¼ of S. 30, T. 12, R. 1 E.*

Roof; shale.
COAL, 12 in.
Shale.

(*199*) *West of Little Warrior about ¼ mile, in the S. E. ¼ of S. W. ¼ of S. 28, T. 12, R. 1 E.*

Roof; shale.
COAL, 9½ in.
Shale; floor.

(*200*) *West of Little Warrior River ¼ mile on a Ridge in the S. E. ¼ of S. W. ¼ of S. 11, T. 12, R. 1 E.*

Roof; shale.
COAL, 21 in.
Shale; floor.

This coal has no luster and is hard; it gives a red ash.

(*201*) *In the N. W. ¼ of S. E. ¼ of S. 15, T. 12, R. 1 E.*

Roof; shale.
COAL, 21 in.
Shale; floor.

This coal has no luster and is hard.

(*202*) *Back of Mr. M. T. Self's Residence, in the S. E. ¼ of S. W. ¼ S. 10, T. 12, R. 1 E.*

Roof; shale.
COAL, 23 in.
Shale; floor.

(*203*) *In the S. E. ¼ of S. W. ¼ of S. 10, T. 12, R. 1 E.*

Roof; shale.
COAL, 6 in.
Shale; floor.

About 100 feet topographically above pit (202) and within 30 feet of the top of Berry Mountain.

(204) *On the West Bank of the Warrior River in the S. E. ¼ of S. E. ¼ of S. 15, T. 12, R. 1 E.*

Roof; shale, hard and curly.
COAL, 24 in.
Shale; floor.

This coal has no luster and gives a red ash.

(205) *In the S. E. ¼ of S. E. ¼ of S. 16, T. 12, R. 1 E.*

Roof; shale.
COAL, 4 in.
Shale; floor.

This pit is about 15 feet vertically above pit (204).

(206) *Near the Top of Berry Mountain on the East Side in the N. W. ¼ of N. E. ¼ of S. 1, T. 12, R. 1 E.*

Roof; shale.
COAL, 6 in.
Shale; floor.

(207) *At the Foot of Berry Mountain on the East side in the S. E. ¼ of N. E. ¼ of S. 1, T. 12, R. 1 E.*

Roof; shale.
COAL, 15 in.
Shale; floor.

(208) *Near the Foot of Berry Mountain on the East side in the S W. ¼ of N. E. ¼ of S. 1, T. 12, R, 1 E.*

Roof; shale.
COAL, 15 in.
Shale; floor.

(209) *On the West side of Puncheon Branch in the S. E. ¼ of S. W. ¼ of S. 30, T. 11, R. 2 E.*

Roof; shale, hard and blue.
COAL, 18 in.
Shale; floor.

This coal is hard and bright.

(210) *On a Small Branch of Warrior River, in the S. W. ¼ of S. W. ¼ of S. 30, T. 11, R. 2 E.*

Roof; shale.
COAL, 15 in.
Shale; floor.

(211) *On the North Slope of Berry Mountain, in the N. E. ¼ of N. W. ¼ of S. 31, T. 11, R. 2 E.*

Roof; shale.
COAL, 18 in.
Shale; floor.

(212) *In a Ravine on the North side of Berry Mountain or in the S. W. ¼ of N. W. ¼ of S. 31, T. 11, R. 2 E.*

Roof; shale.
COAL, 25 in.
Shale; floor.

(213) *Some 500 feet South-east of Dry Creek in Gully in the Mountain in the S. W. ½ of S. E. ¼ of S. 17, T. 12, R. 1 E.*

Roof; shale.
COAL, 11 in.
Sandstone; floor.

(214) *About ¼ mile East of Blountsville Road on the East side of a Small Hill in the S. W. ¼ of S. E. ¼ of S. 7, T. 12, R. 1 E.*

Roof; slate, argillaceous.
COAL, 9 in.
Clay; bluish, floor.

This coal is soft and weathered.

(215) *About 400 feet North of Pit (214), in the S. W. ¾ of S. E. ¼ of S. 7, T. 12, R. 1 E.*

Roof; shale.
COAL, 4½ in.
Shale; floor.

This pit is 40 feet higher topographically than pit (214).

(*216*) *On Side of the Hill about 300 feet South of A. W. Fowler's Residence, or in the N. W. ¼ of S. E. ¼ of S. 29, T. 11, R. 2 E.*

Roof; fire clay.
COAL, 4½ in.
COAL, *clay*, 2 in.
COAL, 15 in.
Slate; floor.

Upper part of the seam is soft and the lower part is hard and bright.

(*217*) *In Bed of Branch ¼ mile North of Amos Fowler's Residence, or in the N. W. ¼ of S. E. ¼ of S. 20, T. 11, R. 2 E.*

Roof; slate.
COAL, 10 in.
Clay; hard, floor.

(*218*) *About ½ mile North-east of Mr. A. W. Fowler's Residence, on the North-east side of Foust Mountain in the S. W. ¼ of S. E. ¼ of S. 20, T. 11, R. 2 E.*

Roof; arenaceous shale.
COAL, 5 in.
Clay, ½ in.
COAL, 10 in.

(*219*) *About 800 feet West of Mr. A. W. Fowler's Residence, on the Side of the Mountain in the S. W. ¼ of S. E. ¼ of S. 20, T. 11, R. 2 E.*

Roof; clay.
COAL, 6 in.
Clay, ½ in.
COAL, 6 in.

This coal is weathered.

(*220*) *Some 300 feet South of Mr. A. Brand's Residence, in a Gully on a Hill Side in the N. W. ¼ of N. W. ¼ of S. 21, T. 11, R. 2 E.*

Roof; clay.
COAL, 2½ in.
Clay, 14 in.
COAL, 3 in.
Clay; floor.

This coal is soft and weathered.

(221) *About ½ mile South of the Huntsville Road and near the Summ it of a Hill in the S. E. ¼ of N. W. ¼ of S. 29, T. 11, R. 2 E.*

Roof; clay.
COAL, 14 in.
Clay; floor.

This coal is soft and is mixed with clay.

(222) *About 300 feet East of Chamber's Residence, on the Side of the Gadsden Road in the S. W. ¼ of S. E. ¼ of S. 18, T. 11, R. 2 E.*

Roof; shale.
COAL, 2½ in.
Clay; floor.

(223) *About 500 feet East of Mr. C. Whitworth's Residence, on the Blountsville and Gadsden Road in the N. W. ¼ of S. 16, T. 11, R. 2 E.*

Roof; sandstone.
COAL. 3½ in.
Clay; floor.

This coal is hard and bright.

(224) *About 200 feet South-esst of Mr. J. A. Honey's Residence, and 20 feet East of a Country Road in the S. E. ¼ of S. W. ¼ of S. 16, T. 11, R. 2 E.*

Roof; shale.
COAL, 3 in.
Shale, bituminous, 3½ in.
Slate, 5 in.
COAL, 3½ in.
Clay, 2½ in.
COAL, 2 in.
Slate; floor.

(225) *North-west of Kerr's House about 500 feet, in the N.W. ¼ of S.E. ¼ of S. 20, T. 11, R. 2 E.*

Roof; clay.
COAL, 5½ in.
Clay, 1 in.
COAL, 10 in.
Clay; floor.

This coal is badly weathered.

(226) *Near Summit of the Hill about ¼ mile North-west of Parson Hames' Residence, or in the N. E. ¼ of S. W. ¼ of S. 21, T. 11, R. 2 E.*

Roof; arenaceous shale.
COAL, 1 in.
Clay, ½ in.
COAL, 6 in.
COAL; *clay*, 3 in.
COAL, 8 in.
Clay, floor.

(227) *On the Side of the Hill 150 feet South-east of the Country Road in the N. W. ¼ of N. W. ¼ of S. 15, T. 11, R. 2 E.*

Roof; clay.
COAL, 5½ in.
Clay; floor.

(228) *About 20 feet South of the Warrior River and 30 feet East of Trail to River from Chambers' House, or in the N. W. ¼ of N. E. ¼ of S. 18, T. 11, R. 2 E.*

Roof; hard, blue slate.
COAL, 5 in.
Slate, 1½ in.
COAL, 4 in.
Slate; 2 in.
COAL, 10 in.
Slate; hard, blue.

This pit is at low water level; the coal is hard and bright, and has in it iron pyrites.

(229) *South-west of Mr. W. I. Pruett's Residence about 600 feet, or in the S. E. ¼ of S. E. ¼ of S. 17, T. 11, R. 2 E.*

Roof; soft sandstone.
COAL, 4 in.
COAL, *clay*, 2 in.
COAL, 3 in.
Clay, 2½ in.
COAL, 5 in.
Fire clay; floor.

This coal is weathered and dirty.

(230) *About 200 feet East of W. I. Pruett's Residence, in a Gully in the N. E. ¼ of S. W. ¼ of S. 16, T. 11, R. 2 E.*

Roof; shaly clay.
COAL, 5 in.
Clay, 2 in.
COAL, 6 in.
Clay; floor.

(231) *On Top of Ridge ⅛ mile South of Pruett's House, or in the N. E. ¼ of S. W. ¼ of S. 16, T. 11, R. 2 E.*

Roof; clay.
COAL, *clay*, 18 in.
COAL, 10 in.
Fire Clay.

(232) *On Side of Branch ¼ mile West of Parson Jim Murphy's Residence, or in the S. W. ¼ of S. E. ¼ of S. 5, T. 12, R. 2 E.*

Roof; shaly clay.
COAL, 6 in.
COAL, *clay*, 7 in.
COAL, 3 in.
Slate, 60 in.
COAL, 23 in.
Black slate; floor.

(233) *About ⅛ mile from the Public Road on Coal Branch (West Berry Mountain) in the N. E. ¼ of S. W. ¼ of S. 36, T. 11, R. 1 E.*

Roof; slate.
COAL, 39 in.
Slate; floor.

This seam or pit, on being driven in some 50 feet farther, gave the following section:

Roof; slate.
COAL, 18 in.

This coal is of a dull color and is curly; it has been used for a long time in the surrounding country and has a great reputation as a blacksmithing coal.

(234) This pit is 80 feet, Barometrically above Pit (233), in the N. E. ¼ of S. W. ¼ of S. 36, T. 11, R. 1 E.

Roof; curly shale.
COAL, 8 in.
Clay; floor.

This coal has been disturbed and is badly weathered.

(235) About 600 feet farther up Coal Creek than Pit (233), in the N. E. ¼ of N. W. ¼ of S. 36, T. 11, R. 1 E.

Roof; sandy shale.
COAL, 19 in.
Slate; floor.

This is the same seam as in Pit (233).

(236) On Coal Branch, about 40 feet above Pit (234), in the N. W. ¼ of S. E. ¼ of S. 36, T. 11, R. 1 E.

Roof; shale.
COAL, 1½ in.
Slate, 1 in.
COAL, ½ in.
Slate, 1½ in.
COAL, 5 in.
Shale; floor.

This coal is bright and glossy, and has a *face and butt structure.*

(237) On Coal Branch. about ¼ mile above Pit (236), in the S. E. ¼ of S. 36, T. 11, R. 1 E.

Roof; curly shale.
COAL, 13 in.
BLACK BAND, 3½ in.
Shale; floor.

(238) On Branch ¼ mile from its mouth or Little Warrior River, or in the S. W. ¼ of S. E. ¼ of S. 5, T. 12. R. 2 E.

Roof; slate.
COAL, 14 in.
Slate; black, floor.

(239) *Near the Top of Berry Mountain, some 350 yards South-east of Public Road, in the S. E. ¼ of S. W. ¼ of S. 25, T. 11, R. 1 E.*

Roof; shale.
COAL, 2 in.
Clay, 5 in.
COAL, 17 in.
Fire clay; floor.

This coal is badly weathered.

(240) *Near the Top of Berry Mountain, some ¼ mile South-east of Public Road, or in the S. E ¼ of S. W. ¼ of S. 25, T. 11, R. 1 E.*.

Roof; shale.
COAL, 14 in.
Shale; floor.

(241) *About 200 feet East of the Public Road, in the N. E. ¼ of S. W. ¼ of S. 25, T. 11, R 1 E.*

Roof; shale.
COAL, 12 in.
Shale; floor.

(242) *About 600 feet North of Elijah Hendrick*'s *House, or in the N. W. ¼ of S. E. ¼ of S. 35, T. 11, R. 1 E.*

Roof; hard, curly shale.
COAL, 19 in.
Shale; floor.

(243) *On the North Bank of Whippoorwill Creek in the N. E. ¼ of S. W. ¼ of S. 18, T. 11, R. 3 E.*

Roof; arenaceous shale.
COAL, 8 in.
Shale; floor.

(244) *About 80 feet above Pit (242), in the N. W. ¼ of S. E. ¼ of S. 35, T. 11, R. 1 E.*

Roof; shale.
COAL, 15 in.
Shale; floor.

This coal is hard and bright, and has a *face and butt structure.*

(245) *About 600 feet West of the Anderton and Blountsville Road, in the S. E. ¼ of S. 3, T. 12, R. 1 E.*

Roof; shale.
COAL, 16 in.
Shale; floor.

This coal is dull and curly, and is evidently of the same seam as pit (233).

(246) *About 900 feet West of Anderton and Brooksville Road und 300 feet West of Pit (245).*

Roof; shale.
COAL, 17½ in.
Slate; floor.

Gen. A. M. Gibson, in 1888, made the following report on that portion of the Raccoon Mountain Coal Measures that lies between the Locust Fork of the Black Warrior River and its principal tributary, the Calvert Prong. The elevated country between these two streams is called *Berry Mountain*. See *Section* 2.

THE BERRY MOUNTAIN COAL MEASURES.—Nearly west of where the *Calvert Prong* of the *Little Warrior* cuts the N. W. rim of Murphree's Valley lies an elevation called *Berry Mountain*. It derived its name from *Robert M. Berry*, who first settled and lived on its summit. It lies partly in four adjoining Townships in S's 11 and 12 of R. 1 E. and T's 11 and 12 of Range 2 East. These four Townships corner on top of the Mountain near its Eastern end. It lies between the *Calvert Prong* of the *Little Warrior* on the south-east, and the *Locust Fork* of the *Warrior* on the north-west. Its boundary on the east is *Jones' Creek*; and its south-west end terminates in ridges between the head waters of the different branches of *Dry Creek*.

The height of *Berry Mountain* is about 325 feet above the rivers on each side. Its strata are nearly horizontal; they have a slight dip, just perceptible, to the north-west. It is not an uplift, or fold, but stands near the middle of the syn-

clinal trough, between the Sequatchee and the Murphree's Valley folds. It is merely a portion of the coal field that has withstood the denudation that has wasted away the surrounding region. It stands as a monument of the far past, when the same thickness of strata that now makes this Mountain, and probably much more, covered the whole adjacent country.

That this high point, or plateau, should have withstood the denuding influences that have swept away so much of the adjacent region, is surprising. It is not, as might be supposed, composed of rocks, or hard strata calculated to resist the abraiding forces; but it is almost wholly composed of shales and slates, that are easily denuded. Hence the little streams that rise within it have deeply eroded it on every side, and have cut down their channels almost to the base level. The top of the mountain is a level, or slightly undulating plateau, encroached upon on every side by deep gorges, with high sharp-backed ridges, with steep sides, between them. The whole structure shows the rapid progress of denudation.

In T. 11, R. 1 E. the *Locust Fork* of the *Warrior* meanders along the base, and round the projecting points of *Berry Mountain*. It enters this township near the south side of S. 25. *Coal Branch* which heads up in the Mountain, a mile and a quarter to the south, empties into the river in the S. E. ¼ S. W. ¼ of this section.

It was named "Coal Branch" by the early settlers of the country because coal was found in it, about a mile from the river. This was probably the first coal bed discovered in the country, at least the first that is known to have been used by the smiths. The seam was thin, only about a foot thick, but of excellent quality. It is said to have been much sought after, and to have been carried far for blacksmith use.

More recently Coal Branch has become more noted, from the discovery by *Mr. Bailes* of a good seam of coal on it, about ¾ of a mile from the river. This is known as the *Bailes Seam*. The first opening on it was made about 100 yards farther up the branch. in a gorge, and the

coal was mainly obtained by stripping till the cap-rock was reached. Coal 20 to 24 inches thick is not sufficient for easy mining. The present works consist of a drift that is cut into the coal seam in the face of tho bluff, about 40 feet above the level of the branch. The coal is run down a chute from the mouth of the drift. When good coal was first reached here, at the edge of the cap rock, the seam was 36 inches thick at one side of the opening and 39 at the other. About 20 feet farther in, the seam was only 18 inches thick. It then gradually increased in thickness and at the farther end is now 24 inches thick. This seems to be about the average thickness of the seam, as observed at many other places. The greater thickness of the seam at the mouth of the drift was caused by what miners call a squeeze, produced here by a fracture in the cap-rock, about 20 feet from the entrance, and greater pressure brought on the seam at that point, which forced the body of the coal towards the outer edge. Over this seam is a hard brownish gray sand rock from five to ten feet thick; in some places it is flaggy but it is generally solid. Below this is a bouldery slate, in concretionary forms; these concretions are large, generally from 2 to 4 feet in diameter. This form of slate is about 4 feet thick; then one to two feet of hard blue arenaceous slate next to and immediately over the coal. The under clay is firm and hard and soon passes into hard slate. The following section was obtained here:

Arenaceous shales and slates, 60 ft.
Hard brownish grey sand rock, 5 to 10 ft.
Blue arenaceous bouldery slate, 4 ft.
Blue arenaceous solid slate, 1 to 2 ft.
Coal, solid, 2 ft.
Clay and slates, of various colors, to level of the river, 90 to 100 ft.

The coal of this seam is peculiar and differs much from any other as yet seen. It is solid and has no describable structure or cleavage planes. It easily crumbles, yet it is hard and firm. Its color is a dull brownish black; it has no luster and looks oily. The coal dust, of which there is much, adheres to the coal, and giving it a dirty appearance. It has

a good reputation as a free burning shop coal and has but little sulphur in it. Its appearance indicates that it is a very free burning grate coal, a good steam coal, and probably an excellent gas coal; but deficient in coking qualities.

From 75 to 80 feet above the Bailes Seam, was found the next bed. It had been cut into only a few feet. The coal was only 8 inches thick, but was evidently thickening. The coal is cubical—covered by arenaceous shales and clay. This seam was also seen in the old workings on the west fork of Coal branch. The coal here is about one foot thick; in some places it is a little thicker. This is the seam that was first discovered, and worked 60 years ago, and from which this branch got the name of "Coal Branch." It is marked No. 5 in the General Section.

Another coal seam was found 25 feet above No. 5; or 100 feet above the Bailes Seam, in the S. E. ¼ of S. 36, T. 11, R. 1 E. Its coal at the out-crop is 13 inches, but it will probably be much thicker when fairly opened. The coal is bright, clean and laminated. The openings on the coal seams throughout this region were mostly made by Messrs. Chandler and Banks for the L. & N. R. R. Co. This is the only opening that is known to have been made on this seam. This is regretted, because it gives promise of being a good seam of coal. Its out-crop is thicker and of better quality than the Bailes bed. It is stated that 2½ inches of black band ore lies under this bed. The opening when seen was partly filled with water and the base of the coal could not be seen. By feeling under the water below the coal, only laminated slate, filled with fern leaves, could be found. This was probably mistaken for black band iron ore. This is No. 6 of the General Section.

Twenty feet above No. 6 the out-crop of another seam of coal was seen but not opened. It is probably a thin seam. These last three seams are embraced in 60 to 80 feet of vertical stata.

On the West Fork of Coal Branch, in this same section, 36, the same series of coal seams and out-crops were seen. No digging had been done there, except the old digging on bed

No. 5 now filled up. The out-crop of bed No. 6 was here very plainly seen in the abraded bluff. It is apparently only 15 to 20 feet above No. 5. The out-crop here showed from 13 to 15 inches of coal. This seam is well worth prospecting for. It will certainly furnish good coal, and is probably thick enough to be easily mined. The out-crop of bed No. 7—20 feet above No. 6—was here also plainly seen.

Above No. 7, between it and the top of the mountain, fossil coal plants were found in the rocks, and there are other evidence of the existence of another coal seam, but its position was not found to a certainty, and so it is unmarked in the General Section.

On the top of the mountain some patches of coal smut were seen, showing the former existence of a coal bed, abraded and decomposed, and all except the vestiges, now washed away.

For greater convenience of description, and to give a clearer knowledge of thickness of strata, and the relations of the different seams of coal, the following *General Section* of this field is given in descending order:

GENERAL SECTION OF BERRY MOUNTAIN COAL MEASURES.

Slates, generally hard, *arenaceous*, some sand rock, shales hard (probably a thin seam of coal exists in this group), ferruginous clays at top of the mountain, with some soft shale, 90 ft. to 100 ft.

(7) COAL, thin seam, thickness unknown.

Shale, hard, curly, 15 to 20 ft.

(6) COAL, good, 1 ft. 1 in. to 1 ft. 3 in.

Slates and hard shales, 20 to 25 ft.

(5) COAL, old bed on *Coal Branch*, 1 ft. to 1 ft. 2 in.

Slates, some hard sand rock and shales, mainly arenaceous, 75 to 80 ft.

(4) COAL, *Bailes Seam; Hendricks'*, *Jones'*. *Moses'* bed, etc., 1 ft. 6 in. to 3 feet.

Slates, mainly *argillaceous*, colors various, brown, dark gray and light blue, 90 to 100 ft.

Flaggy sandstones and hard slates, 25 to 30 ft.

(3) COAL, in river at J. A. Murphree's, Dan Murphree's, etc., 1 ft. 9 in. to 3 ft.

Sandrock, heavy bedded, running into thin flaggy rock, a good building stone, 90 to 100 ft.

(2) COAL, good, 1 ft. to 1 ft. 6 in.

Sandstones, hard, flaggy, passing into hard gnarly shales, 100 to 120 ft.

(1) COAL, seam No. 1, variable quality, 1 ft. to 1 ft. 3 in.

Sandstones, soft and friable, and flaggy and hard, hard shales, ferruginous shales, and some carbonite of iron, 150 to 200 ft.

Second Conglomerate; pebbles abundant in places, irregular in structure, base generally hard and pebbly, upper part soft friable sandstone, with few pebbles, color from light gray to brown, 50 to 60 feet.

Sandrock, thin and flaggy; *shales* and *clay*, 25 to 30 ft.

LOWER CONGLOMERATE; *millstone grit*—hard massive rock, pebbles generally small, pebbles in patches and bands, more in lower than in upper part; generally a light gray, coarse grained rock, 50 to 60 feet.

Ferruginous clay, some *limonite*, and some *carbonite of iron ores; shales*, and thin sandrock, *blue slates*, and in places a thin stratum of coal, 30 to 40 ft.

CARBONIFEROUS LIMESTONE below base of Coal Measures.

DETAILS.

In a detailed description of this region, a clear conception of it can be obtained by beginning at its lowest measures on the Murphree Valley side, thence crossing the strata towards the North-west till the highest part of the mountain is reached.

Almost everywhere along the North-west side of Murphree's Valley, the base of the coal measures is visible. In a few places, where the Carboniferous Limestone has not been sufficiently elevated, or the debris from the uplifted edge of the valley has slidden down over the limestone, the base of the coal measures cannot be seen; but these are exceptional cases, and are not sufficiently numerous or extensive, to raise any doubt of the structure which can be clearly made out at a great number of places where it is fully exposed. The coal measures here rest directly on the top of the limestone; without any calcareous shales or impure shaly limestone to mark the transition from one formation to the other. The change is sudden and abrupt from lime-

stone to ferruginous clay which gradually passes up into a ferruginous arenaceous shale. The color of both clay and shale varies at different places. They both generally contain more or less iron ore, mainly limonite. This ore, however, is seldom, if ever, in sufficient quantity to be of economic value.

Above the ferruginous shale, come thin bedded sand rocks and beds of clay, sometimes succeeded by slates. At a few places, blue to black slates, have been seen at this horizon, and in one of these places a little seam of coal, about 3 inches thick, in detached spots, was seen. *The sub-conglomerate coals do not underly* this portion of the coal field.

The whole thickness of the *sub-conglomerate* measures, as shown along the whole South-eastern face of this field, is only from 30 to 40 feet. This is considered to be a full average. In no place have they been found to exceed 50 feet, while in places they show only about 20 in thickness. The great difference between these measures and the BLOUNT MOUNTAIN measures in *this* and *other particulars* will be shown hereafter.

The *Lower Conglomerate* here presents no special features. It presents the same massiveness and general distribution of pebbles wherever seen. The *Second Conglomerate* is less pebbly in the upper than in the lower part, and has rather the character of a coarse grained friable sandstone. In the lower and middle parts, in spots and bands, there are many pebbles, generally small and firmly cemented together.

The small amount of strata between the First and Second Conglomerates, and the total absence there of any coal seams, is very unusual. In this field, these *two conglomerates* might and ordinarily would be taken and considered as *one*. It was only after discovering that there was no other conglomerate in this coal field, that it was observed that the two were nearly united. The usual thickness of the flaggy rocks and other strata between them, which contain no pebbles, is about thirty feet. On the North-western side of this field, at the edge of the Sequatchee, or Blounts-

ville valley fold, the *upper* or Second Conglomerate is much harder and more massive than the *Lower*. The Lower Conglomerate has here lost its distinctive *mill stone grit* quality, and has become a soft, often reddish colored, coarse friable pebbly sand-rock. It is hence the *Second* or *Upper Conglomerate* which in that region bears the name of "*mill-stone grit.*"

Above these two conglomerates there are from 150 to 200 feet of rocky strata to a thin seam of coal. This seam is only about a foot thick, probably 18 inches would be its maximum thickness. So far as seen it is of inferior quality. Above this seam there are hard rocky strata, generally thin bedded and flaggy, and some hard shale. for 100 to 125 feet, making in all from 450 to 500 feet at the base of the measures that are nearly destitute of coal.

On the Whited Mill branch, about ¼ of a mile below where it cuts the rim of the valley, in S. 24, T. 12, R. 1 E., there is the following approximate section of the lowest bed in this field, or of No. 1 of the *General Section:*

SECTION IN S. 24, T. 12, R. 1 E.

Flaggy sand rock, and hard shales, making the side of the mountain		75 feet.
Hard slate over coal seam		2 "
COAL	8 inches.	3 ft. 1 in.
Clay	2 feet.	
COAL	5 inches.	
Hard slate below water level; unknown thickness.		
Hard sand rock; generally thin bedded; sometimes massive; down to conglomorate; 175 ft. and over.		

This coal seam was opened here in the bed of the branch a few years ago and some coal taken out. The coal is said to be of good quality, but its position is unfavorable for mining and the thickness of the coal would not compensate for the labor in taking it out. It is now covered by water, and the excavation nearly filled up.

This same seam was found several miles farther down the mountain to the south-west, on a little stream called Big Branch, in S. 5, T. 13, R. 1 E. The coal here showed about the same thickness, and, so far as cut into, it is of poor quality.

The coal seam No. 2 of the *General Section* is exposed at several places in the smaller streams which empty into the Calvert Fork of the Little Warrior on the South-east side. About ¼ of a mile above the mouth of *Mill Creek*, and near the line between S. 33 and 34, T. 12, R. 1 E, at the side of the creek, this seam has been cut and some coal taken out. The coal here is hard and glossy with a peculiar *conchoidal fracture*. Its appearance would indicate that it had been subjected to a sliding pressure which deranged its structure and forced it into feather edges with a conchoidal cleavage. The coal is sulphury and rather unsuitable for blacksmith work, though it is free burning coal. It would answer very well for burning in grates and for domestic use. It is probable that the peculiar structure of the coal here is only local; it has not been seen anywhere else. The thickness of the bed is from twelve to fifteen inches.

In the bed of the *Calvert Fork*, half a mile or three quarters above the mouth of *Mill Creek*, a small seam of coal is exposed. It is supposed to be the same seam (No. 2). Its thickness here is about one foot. The coal is cubical and its quality fair to good.

Near the eastern side of this T., and probably in S. 13, in a ravine coming down from the mountain, there is some showing of coal; it is not opened and is supposed to be also an out-crop of seam No 2. This is near to and south of Dan Murphree's.

Near James A. Murphree's, in the N. W. ¼ of N. E. ¼ of S. 8, T. 12, R. 1 E., on a branch flowing into the Calvert Fork from the North, is a fair showing of coal. This is seam No. 3 of the General Section. The coal had been cut at the very edge of the branch, where it is dipping from 3″ to 5° to N. W. This drip carries it below water level from the start, and so it is unfavorable for working. The seam here is 23 inches thick and has a good appearance. It has not been as yet tested. On the opposite or eastern side of the branch, an opening had been made on the same seam. There it is near the surface and has no roof, and the coal is almost wholly decomposed. The thickness of the decom-

posed seam is three feet. A decomposed seam that is not under much pressure will occupy a thicker space than the same quantity of coal when solid and compact; yet, some allowance for wastage must always be made in the case of decomposed coal. It may be safely inferred that the wastage here has been considerable, and that the solid bed of coal, when fully exposed, will approximate the thickness of the decomposed seam.

Some out-croppings of this seam were also seen farther to the south-west and close to the Calvert Fork. If this seam could be opened here or at some other place above water level, in an excavation at a right angle to the dip, so as to be self-draining, it could be satisfactorily tested. This seam presents here as good a prospect as any other seam in the field, and it is very desirable that its thickness and quality should be fully tested.

In several places to the South-west, or farther down the Calvert Fork, coal is known to occur in deep holes of the river; they are probably the same seam. Also in Section 7 of the same township, on or near the lands of Daniel Murphree, on a high point south of the river where the strata seemed to be abnormally elevated, some coal has been mined in former years. The opening here was totally filled up and the thickness of the seam could not be ascertained. From the overlying strata here, of which there is a good exposure, this coal is judged to be the same as the Jas. Murphree's bed, or Seam No. 3.

In the same geological horizon, on the lands of Obea Ellis in the N. E. ¼ of N. E. ¼ of S. 22, T. 12, R. 1 E., the same bed was also found. It was only partially exposed here in a deep spring, in a hollow 10 to 15 feet above the level of the river. Its position was found to be approximately 100 feet *below the Bailes Seam*, or No. 4 of the *General Section*. It has already been stated that there is no coal seam lying between the *Bailes Bed* and the water level of the Locust Fork of the Warrior River, and that from 90 to 100 feet of slate, or slaty strata, are there exposed. The Bailes Seam had been cut and identified at the place now

under consideration, in Section 15, a little over half a mile to the north and 100 feet above the coal in S. 22, at Mr. Ellis.' It is therefore evident that Seam No. 3 is the first one below No. 4 and that the space between them is about 100 feet. The measurements made on both sides of the mountain agree well, and very satisfactorily establish the relation of these seams to each other.

Seam No. 4 of the General Section is known as the *Bailes Seam.* So far as development has yet gone, it is the most important seam in this region. It is a very persistent seam of nearly uniform thickness and quality, so far as yet exposed. The openings made on it by David Bailes, in S. 36, T. 11, R. 1 E., have been already described and need not be repeated.

In the N. W ¼ of the S. E. ¼ of S. 35, in the same Township, on the lands of E. D. Hendricks, another opening was seen on this seam. It was not cut here beneath the cap rock, and the full thickness of the seam was probably not reached. The coal was 18 inches thick; it was cleaner and brighter than at the Bailes openings. It is here the same level, and its cap-rock and roofing slates are identical with the Bailes opening.

Below the Hendrick's opening was a good exposure of the underlying slates. These slates were traced down the bed of the stream for 90 feet below the coal seam. No fossil coal plants were found, nor any evidence of an underlying coal bed. At the lowest exposures reached, a few marine shells were found and also some fragments of plants apparently also marine. Below this, the surface was wholly covered with silt, and, even in the bed of the stream, the slates were not exposed.

Another opening on this seam was seen in S. 30, T. 11, R. 2 E., on the Moses place. The digging here is in the face of a bluff, at a very good place to open the seam, about 10 feet above the bed of a little branch. The cap rock is well exposed, but the coal had not been cut into far enough to reach it. No good or solid coal had therefore been reached in this opening. The thickness of the soft, loose,

and partly decomposed coal is 3 feet. How much of this is due to swelling and slacking by decomposition, or to crushing out from under the edge of the cap rock, cannot yet be known. It seems to present a condition similar to what was found at the Bailes opening, which has from 36 to 39 inches of coal at the edge of the cap rock and only 18 inches 15 to 20 feet farther in. Judging from the general thickness of this seam, as observed at different places, it is hardly probable that it will maintain its present apparent thickness. This opening ought to be driven in farther and the character of the bed here revealed.

The most interesting thing found here was a number of joints, or sections, of a *Stem of Sigillaria* 8 inches in diameter. It stood among the loose shales above the coal. The leaves and marking of the leaves of *Sigillaria* are exceedingly common in the rocks above these coal seams, but the petrified stems are not often found.

This seam was also seen at out-crop on the north side of the mountain about half a mile north of the Moses opening. It is also opened, and some coal has been taken out, on the lands of Mr. Jones, a half a mile or so farther east.

Near the South side of S. 10, T. 12, R. 1 E., on the South side of Berry Mountain, on the lands of Marion Self, this seam had been opened. The cut was not driven in far enough to reach the cap rock, and there was nothing but drift above the coal. The cap rock was plainly to be seen about 20 feet farther up the branch. It is identical with the rock seen capping this seam at all the other openings. The same peculiar blue to reddish colored bouldery slate occurs in the lower part. The upper part is an imperfectly laminated arenaceous hard shale, changing gradually into a hard compact reddish colored sand rock. This cutting was also at the same level as the Bailes bed, and other openings already mentioned. No doubt of its identity was therefore entertained. The strata here showed a very slight dip, just perceptible to the N. W. The coal here has almost the same appearance and characteristics as the *Bailes bed* on Coal

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Branch, only it is less hard and firm. It is here merely the out-crop. The seam here is 2 feet thick, and, when fully opened, will yield coal similar to, if not identical with, the Bailes openings.

In the S. W. ¼ of the S. E. ¼ of S. 15, in the same T., another opening was seen in this seam. The coal here is less firm than in S. 10. The only roof here is shale. The seam at this place is near the surface, and good coal could not be expected in the place where the opening was made. The position of the seam at this opening is 20 feet higher than at the opening in S. 10; it thus shows that the seam here has a North-west dip of about 20 feet to the mile.

In the N. E. ¼ of the S. E. ¼ of S. 16, in the same T., on the lands of Mr. Al. Blackwood, the same seam had been partially opened. The roof here is a reddish curly shale; the firm coal has not yet been reached. This and the two or three last mentioned openings had been made by prospectors about a year ago. The object seems to have been to find and trace certain seams, rather than to test their qualities. The dipping was stopped as soon as the thickness of the bed was ascertained. No work has been done on any of these last openings since they were made, and in some cases the excavations are partly filled up. The bottom of the bed in this opening could not be seen. The thickness of the seam here is said to be 25 inches. The opening is on the South side of a high hill, and, had the drift been cut in far enough, doubtless good coal would have been found.

All of the openings on this seam show that it underlies the whole of Berry Mountain, and may be mined on all sides of the mountain, and on all the spurs of it, which extend down between the different forks of Dry Creek, and between South Dry Creek and the Calvert Fork of Little Warrior. The quality of its coal, so far as can be judged from the outcrops is very uniform. The seam will doubtless yield, throughout, a good *grate coal* and probably an excellent *steam and gas coal.* It may do reasonably well for blacksmith work but its coking qualities are seriously doubted. It is, so far as yet known, the best coal bed in the Berry

Mountain region; and as it is the lowest seam above water level, in that portion of the country, it is of course the most extensive, and the most available for easy approach and mining.

Coal bed No. (5) of the General Section was first seen on the West side of Coal Branch in Section 16, T. 11, R. 1 E. A small opening had been made on the seam. The coal here is thin, but increasing in thickness. It is roofed over with hard curly shale. No cap rock was reached. The coal is cubical and is of good quality, but it is only 8 inches thick. Its position by anæroid measurement is 75 to 80 feet above the *Bailes Seam.*

On the West fork of *Coal Branch*, at the same level, it was seen at the "*old diggins*" in the bed of the branch. It is said to have been worked many years ago. The seam is said to be 12 to 14 inches thick and the coal excellent, free from sulphur, and suitable for the finest blacksmith work. Its out-crop was also seen on the East fork of Coal Branch in the same section.

Seam No. (6) was first seen on the East fork of Coal Branch in S. 36, T. 11, R. 1 E. A small cut had been made into it on the side of the bluff just above water level. It was only dug into a few feet. The coal cut out was of good quality; it was hard, bright and cubical. It was 13 inches thick. This was not a fair test of the seam; it is doubtless much thicker farther in. Another out-crop of this seam was seen in the bank of the West fork of Coal Branch. The natural exposure there measured 15 inches in thickness. No cap rock was seen at either of these out-croppings of No. 6. Its position is 20 to 25 feet above seam No. (5) and 100 feet above the *Bailes Seam*, No. (4).

On the south side of Berry Mountain, in S. 11, T. 12, R. 1 E., a thick bed of coal smut and soft coal was seen in the road. It was judged to be the out-crop of this seam. It was apparently too thick for either the little seam above or below this one, and it was much above the level of the Bailes bed. No opening had been made here, nor is any other opening or exposure of this bed known of on the moun-

tain. This bed is one of much promise. It may not prove to be thick; probably not thicker than the Bailes Seam, and yet it is thicker at the out-crop than that seam usually is, and the quality of its coal, at the surface, is much better.

Coal Seam No. (7) lying 15 to 20 feet above No. (6) is a thin seam. Only one small and imperfect opening was seen on it. This opening was just above No. 6 on the East Fork of Coal Branch. Only coal smut was reached, and the thickness of the seam could not be determined. It seemed to be less thick and less promising than the bed immediately below it. Its out-crop was also seen at the same horizon on the West Fork of this branch.

The three seams, Nos. 5, 6 and 7, are very close together. They are all included in 35 to 45 feet of vertical strata. In this respect, and also in thickness, they resemble the group of seams numbered "(6), (7) and (8)" in Jefferson county, as given by PROF. MCCALLEY in his "*General Section* of the Warrior Coal Field." See Biennial Report for 1886, page 276. They may be the same beds. Perfect similarity and identity could not be expected in either coal seams or other strata at places widely separated, even in the same Coal Field. It also now seems more than probable that the great Warrior Coal Feld in its origin had natural divisions in it and consisted of a *series of coal basins*, rather than a homogeneous field. This will be noticed more hereafter, under the head of OBSERVATIONS.

Most of the work of prospecting and of opening of coal seams in this region has been done by MESSRS. CHANDLER and BANKS, for the L. & N. R. R. Co. They rarely if ever penetrated far enough, to show a fair sample of the coal. They supposed that the *Bailes Seam* is the well known *Black Creek Seam* of Jefferson county and persistently hunted for the *Jefferson Seam*, 30 to 50 feet above it. In this, of course they were disappointed. The *Bailes Seam* cannot be identical with the *Black Creek*. There is not a single point approximating identity in their structure or surroundings. The horizon of the *Black Creek* is from 800 to 1,000 feet *above the Bailes Seam*. The Bailes

Seam is within 225 feet of the top of the measures, hence the *Black Creek* and all overlying seams *do not exist* in this region. No evidence has yet been seen here even of the *Warrior Seam*, and it may be safely stated that it does not exist in the Berry Mountain region. All of the 7 or 8 seams yet found in this portion of the field belong *near the base of the measures*, and have their *representatives*, if not their equivalents, in the seams below No. (9) of the *General Section* of the Warrior Coal Field in Jefferson county as shown in PROF. MCCALLEY'S *Report*.

It is possible that the measures of Berry Mountain may be sunk by a fault along its South-east side and so have a greater thickness of coal measures than herein shown. The evidence of the existence of such a fault is rather suggestive than conclusive. Along the course of the Little Warrior is the dividing line between the hard sand rocks highly inclined on its South-east side and the nearly horizontal slates and shales of Berry Mountain, on its North-west side. The North-west dip of the hard sand rock strata terminates here often very abruptly and does not show a gradually decreasing dip, as might be expected in synclinals where there is no fracture. Then the sandy soil and the shaly soil formed by the decomposed rocks on the opposite sides come together at a *well defined line*, about where the dip of the Sand Mountain side terminates; and often there is a distinct depression along the line of junction. Again, at one point it was observed that the sand rock to the South-east of this junction line of soils was about 10 feet higher than the slates on the North-west side. This could not clearly be accounted for except on the hypothesis of a fault; and, taken in connection with the other evidence, seems sufficient to render the existence of a fault probable.

If a fault exists here, it is believed that the down-throw of the Berry Mountain side is *not very great* and probably will not materially change the estimate of the whole thickness of its coal measures.

At two places on the South-east side of the Calvert Fork, the Berry Mountain slates were seen capping the Sand

Mountain strata. Their relation was clearly shown at these points and it is certain that, if any down-throw exists here, it has not been great enough to engulf any coal seam or to obscure their relations.

OBSERVATIONS.

The region in which Berry Mountain is situated shows the results of great denudation. The mountain itself is a mere remnant of a once extensive plateau. Standing on its top the denuded area can be clearly seen on both sides and to extend down the synclinal trough far to the South-west. Measured by the height of this mountain, all this denuded region has evidently lost over *300 feet* of its strata. How much more than that it is now impossible to estimate. It is very evident, however, that the top of BERRY MOUNTAIN was not the *original top* of the coal measures, for remnants of a decomposed coal bed are found there. The drainage of part of the Sequatchie or Blountsville Valley fold, and of all the region South of the *Raccoon and Blount Mountains*, and west of the *Eastern rim of Blount Mountain* to its Southern end, flows into and down this synclinal trough. The confluent waters from this extensive watershed have washed and eroded the whole region between the Murphree's Valley and Sequatchie folds. The base level of its streams is now from 100 to 200 feet below the floor of the valley folds on each side, and the height of the country generally is not great above the streams. Berry Mountain, Foust Mountain, and a few prominent ridges only remain as monuments of the past and relicts of the wreck produced by erosion. Judged by the thickness of the measures on the opposite side of Murphree's Valley, and under the assumption that the coal field was originally the same on both sides, it would seem that these had lost over 1000 feet. We find, however, very great differences in the structure and in the strata of these two sections. A few of the most prominent of these differences will be briefly considered.

In this field, as has been stated, there is very little of coal strata below the *Lower Conglomerate*, only 30 to 50 feet. This thin streak of measures carries no coal on the North-western side of the field, and only the merest fragment of one seam, seen only at one point, on its South-eastern side,* while in the Blount Mountain field the strata below the *Lower Conglomerate* are fully *600 feet thick*, and have *four seams of coal.*

The strata also of these *sub conglomerate* measures are very different in these two fields. In this one they are almost wholly made up of ferruginous shales and reddish or bluish clays. In the other, they are largely composed of *Slates* and hard grey arenaceous shales or hard sandrock. These differences are shown on the South-east faces of these fields, which are only 10 to 12 miles apart. The same great thickness of *sub-conglomerate measures* is shown still farther to the South-east, in *Chandler's Mountain*, and extends along the South-east face of the Blount Mountain for more than 40 miles. It is therefore hardly probable that they diminished to a farther edge in so short a distance to the North-west. It is more probable that the Jones' Valley, and Murphree's Valley uplifts, are on a line that *marked a division between the Cahaba and Blount Mountain* coal fields, on one side, and the *Warrior and Cumberland Mountain coal field*, on the other.

Again, in this field, there is no coal between the *Lower* and *Second Conglomerates*, and but very little, so far as is known, in the Warrior field, while in the Blount Mountain there are *two thick seams*, and over 300 feet of strata. This is a difference that is inexplicable, if the fields are regarded as identical.

Again, in this field, the upper portion, over 300 feet thick, is almost wholly composed of *slates* and *argillaceous shales;* in the other there is no corresponding body of strata at a similar horizon. This might be regarded as a local and

*The Cliff Seam, just under the *Millstone Grit*, has been seen by me in several places on the North-west face of the mountain, next to the Blountsville Valley. H. McC.

accidental difference were it not so extensive, but the same great body of slates are found in all the ridges and high points for many miles. They make the country between the Locust Fork and the Calvert Fork at least as far down as the junction of the Little Warrior. In the Blount Mountain field there is a considerable body of slates, but they lie over 100 feet *above* the *Third Conglomerate*, and include the 14th seam of coal from the base of that field. Hence these and the Berry Mountain slates *cannot be identical.* They are a portion of coal measures that now, at least, are wholly wanting in this region.

In addition to these great differences in the strata and general structure of these two contiguous coal areas, it may be added that their *coal seams* are *wholly unlike.* There is not, so far as yet seen, a single seam that is common to both fields. None of them are identical. They differ in quality and thickness of coal, and in their relation to strata or position in the measures. This will be readily seen by comparing together the *detailed sections* of the two fields. Their differences will be found too great for any semblance of identity.

All these facts go very strongly to prove that the Berry Mountain coal field and the Blount Mountain field, though separated by only a few miles of valley, yet they belonged originally to two different coal basins. The former showing a similarity to the base measures of the Warrior field, the latter having no seam yet shown to be even similar in character or surroundings to any one of the Warrior seams.

Whether there is a close relationship, or identity of structure, between the Blount Mountain field, and the *Cahaba* or *Coosa fields*, cannot yet be determined.*

The advantages for mining the coal of the Berry Mountain field are excellent. All the strata in its central parts, including the mountain, are nearly or quite horizontal. All

*The Raccoon Mountain coal measures are as different in localities of its own, connected by unbroken strata, as they are from those of Blount Mountain, and so the above argument does not prove that the coal measures of Raccoon and Blount Mountains were necessarily originally of different coal basins. H. McC.

mines and openings and drifts on its coal seams can therefore be made self-draining. All of its coal can be rolled to the dump on horizontal tramways. The expense of mining will therefore be much less than is usual in coal mines. Here the many gorges and deep hollows cut into the mountain will enable the seams to be opened at any desired point, and at a great many different points, on all sides of the mountain. Mining may therefore be done here by all those who own the lands that contain the coal seams. It may be done at their convenience, or when not otherwise employed on their farms. Mines and drifts properly constructed will remain unobstructed and in working order for years. Hence mining operations may stop without detriment to the works and be resumed again at pleasure. This is an advantage that few coal mining regions possess.

The same advantages may also be attained on the South-east side of the Calvert Fork, if any seams be there found thick enough for tunneling. Advantage being taken of the dip of the strata secures self-drainage of the mine and easy out-put of the coal.

All but one of the known seams of coal in this field are above water level, wholly or in part. All that portion of the lower seams which lies South-east of the Calvert Fork, and the four upper seams of Berry Mountain, have the above advantages. Only in the upper seam of the lower or Sand Mountain series (the out-crop of which is near or in the bed of the river) will there be found any trouble with water in mining.

This coal field has also an advantageous position for marketing its coal. It lies but a few miles from Murphree's Valley. Nearly opposite to it is the gap in the rim of the valley, through which the Calvert Fork runs, from the valley to the base of the mountain. Through this gap a favorable outlet for its coal, to a promising future market, already exists. A railroad could be built, with an easy grade, through this gap. The length of the branch road here necessary to connect with the Birmingham and Huntsville railroad would be about three miles. The future of

this coal field, therefore, depends wholly on its *capacity* and the *quality* of its coal, both of which can only be shown by more extensive development.

C. The Sand Mountain Coal Measures.—The portion of these measures that is within this county is of a very irregular shape. The county line is the Mulberry Fork of the Black Warrior River down to nearly opposite Hanceville, when it leaves the river and runs in a general W S W. course, by broken lines, to R. 5 W., in T. 12, thence south 15 miles to T. 15, and thence in an E N E. course, by broken lines, to the L. & N. R. R., south-west of the end of Brown's Valley, where the Coal Measures of Sand and Raccoon Mountains blend into each other. The area included between this broken line and Brown's Valley is the portion of Sand Mountain that is within Blount county; it is all coal measures and embraces some 130 sq. miles. The south-east edge of this area was elevated by the anticlinal fold of Brown's Valley, and so the dip is away from this valley or to the north-west. This dip along the crest of the mountain varies from 45° to N. W. to 85° to S. E. It rapidly flattens, however, and there is along the county line the normal dip of 3° to 4° to the S S W. of the Warrior Coal Field. (See section 2.) The anticlinal fold of Brown's Valley continues unbroken, in the coal measures along the county line, to the south-west of the end of the valley to the south-west corner of this county. As the general dip to the south-west is greater than the inclination of the surface, the measures, of course, thicken in that direction and are thickest in the south-west corner of the county where they will measure over 1,200 feet in thickness. These thickest measures include 6 to 7 seams of coal. Only the two uppermost seams however are of workable thickness and the uppermost one is too near the surface or top of the highest points in the south-west corner of the county to be of any commercial value. The remaining seams are less than a foot in thickness.

DETAILS.

Near the county line, though in Cullman county, in S. 14, T. 12, R. 4 W., is the *Aycock coal bed.* The coal is firm and good, but it is only 14 inches thick. It has a good cover of hard massive sandstone that forms a bluff over the coal out-crop. This bluff has been undermined for some 20 feet back from its face, by the neighborhood blacksmiths in digging out the coal, and still it stands firm without any supports. The underbed to the coal is a fire clay. This coal bed is believed to be the well known *Black Creek Seam* of Jefferson county.

The *Bremen coal bed* is in S. 22, T. 12, R. 4 W. At this bed there is the following badly weathered out-crop:

SECTION AT THE BREMEN COAL BED, IN S. 22, T. 12, R. 4 W.

(6) *Soil, loose sandstones;* about 25 ft.
(5) COAL SMUT, 3 in.
(4) *Shale;* soft and blueish, 4 in.
(3) *Shale,* COAL; the shale is blue and black, and occasionally a sandstone; the *Coal* is in thin streaks in the shale and sandstone, 4 ft. 9 in.
(2) COAL; hard and good, 1 ft. 1 in.
(1) *Shale, Debris.*

This outcrop is also believed to be of the Black Creek Seam, though it may be of the *Jefferson Seam*, Jefferson county.

There are said to be coal exposures also in S. 21, T. 12, R. 4 W.; they are doubtless of the Black Creek and possibly also of the Jefferson Seam, the two uppermost seams. There are out-croppings of a lower thin seam in Dorsey's Creek in S's 29 and 31, T. 12, R. 4 W. The out-crops in S. 31 are said to be about 8 inches thick, though in Mr. S. J. Stewart's well, in the northern part of the section, this same seam of coal is said to be only 6 inches thick. At Mr. W. S. Leeth's two springs, in the S. E. ¼ of S. W. ¼ of S. 1, T. 13, R. 5 W., there are out-crops about one foot in

thickness of a seam of coal covered by a light yellowish sandstone that on the weathered out-crops is friable or soft and a little shaly in places. Some 50 feet under this seam of coal there appears to be another seam as seen in the road from Mr. Leeth's down to his mill, about in the S. W. ¼ of S. E. ¼ of S. 1, T. 13, R. 5 W. The upper of these seams is believed to be the *Black Creek Seam*, though it may be the Jefferson Seam.

At Mr. S. W. York's spring, in S. 5, T. 13, R. 4 W., there is an out-crop of coal that appears to be about 2 ft. thick. This seam of coal crops out also some 200 yds. down the spring branch at the crossing of the road. It is covered by a coarse orange sandstone and has an underbed of fire clay. It is the *Black Creek Seam*.

The *Clifty Coal Bed*, in S 7, T. 13. R. 4 W., has about the following section:

SECTION OF CLIFTY COAL BED, IN S. 7, T. 13, R. 4 W.

(9) *Sandstone;* massive and of an orange color, a little slabby in places, 20 ft.
(8) COAL; very hard, in patches in the sandstone, 3 in.
(7) *Sandstone;* variable in thickness, 10 in.
(6) COAL; in patches, 3 in.
(5) *Sandstone*, 9 in.
(4) COAL; cubical, variable, in places are impure *black-band ore*, 3 in.
(3) *Shale*, COAL; the *Coal* is variable and is in thin sheets in the shale, 3 in.
(2) COAL; very hard and good, 2 ft. 5 in.
(1) *Shale, Debris.*

From (3) to (8) inclusive of this section are very irregular and occur only in places. This coal bed is at the head of a ravine, under an overhanging crescent shape bluff. The strata in the upper part of this bluff appear to dip about 15° to the S. W.; they are in waves from N. E. to S. W. This bed is the *Black Creek Seam*, and is about 325 feet above the Mulberry Fork of the Black Warrior River.

Near the top of the mountain in the Bremer road, soon after leaving Arkadelphia, in the S. W. ¼ of S. 16, T. 13, R.

4 W., is an out-crop of coal about 6 inches thick with a sandstone cover and a fire clay underbed. It is either the Jefferson or Black Creek Seam. In the S. W. corner of T. 13, R. 4 W. and the S. E. corner of T. 13, R. 5 W., there are several known out-crops of the Black Creek Seam. Some 70 to 75 ft. above these out-crops, when the hills are high enough, there are appearances of another seam which must be the Jefferson Seam, and some 175 ft. under the Black Creek Seam there are reported out-crops of coal in the Mulberry Fork of the Black Warrior River.

In the field some 40 feet below Mr. Jessie Stephen's house, in the N. E. ¼ of N. W. ¼ of S. 36, T. 14, R. 5 W., there is an out-crop of coal smut about 3 inches thick, with a few inches of clay just under it, and then a shaly micaceous sandstone full of plant impressions.

There is also just over this smut a few inches of clay, and then debris that may hide more coal.

In S. 20, T. 14, R. 4 W., there is said to be a good bed of coal.

In Mr. Paris' well, in the S. E. ¼ of S. 12, T. 14, R. 4 W., there is said to be a thin seam of coal. It is probably the first seam over the *Upper Conglomorate*, as this conglomerate is the surface rock about one mile to the north-east on top of the undenuded Brown's Valley anticlinal fold.

At Hanby's Mill, on the Mulberry Fork of the Black Warrior River, in the N. E. corner of S. 35, T. 13, R. 4 W., the strata dip from 8° to 20° to N. W.

In the Arkadelphia road about one mile from this mill, in the S. W. ¼ of S. 26, T. 13, R. 4 W., there is a thin out-crop of coal smut over fire clay; and in the N. E. ¼ of S. 27, T. 13, R. 4 W., there is an exposure of a coal seam about 3 inches thick. In Mr. F. A. Hewitt's field, in the banks of the river about ten feet above low water mark, in the N. E. ¼ of S. E. ¼ of S. 26, T. 13, R. 4 W., there is an out-crop of coal about 6 inches thick. Some three-fourths mile up the river, or in the S. E. ¼ of S. 23, T. 13, R. 4 W., there is said to be in the river an out-crop of coal some 2 feet thick. On top of the

mountain in the N. W. ¼ of S. 30, T. 13, R. 3 W., there is said to be a large basin or pond.

In the S. E. ¼ of S. 4, T. 14, R. 3 W., there is said to be an out-crop of coal, and in a cut on the L. & N. R. R., at the south-west end of Brown's Valley, in S. 27, T. 13, R. 3 E., there is an out-crop about 12 inches thick of the coal seam just under the *Lower Conglomerate, the Cliff Seam.*

The dip along the north-west edge of Brown's Valley varies from 45° to N. W. to 85° to S. E. The river, between Blount Springs and Garden City, is just to the north-west of this elevated rim, of principally the Lower and Upper Conglomerates.

A six inch seam of coal is said to occur in the river, in the S. E. ¼ of S. 30, T. 12, R. 2 W., and about ten feet above low water in the river in the S. W. ¼ of S. 16, T. 12, R. 2 W. This seam of coal is perhaps 35 to 40 feet above the Upper Conglomerate. At Mulberry Mill, in the S. W. corner of S. 20, T. 12, R. 2 W., are some false bedded strata in the west bank of the river. In a gap through the rim of the mountain in the N. E. ¼ of S. 10, T. 12, R. 2 W., there is a spring of very strong chalybeate water that may have its origin in a thin seam of coal. The dip in this gap is about 70° to N. W. In Mud Creek in the N. W. ¼ of S. 27, T. 11, R. 2 E., there is said to be an out-crop of coal. In the S. E. ¼ of S. 30, T. 11, R. 1 W., the Lower Conglomerate or Millstone Grit is more than perpendicular, or is bent over to the north-west until the dip on the out-crop is some 85° to S. E. Just to the north-west of Gum Spring, in the S. E. ¼ of N. W. ¼ of S. 29, T. 11, R. 1 W., there is in an old road an out-crop of coal smut about 8 inches thick over 4 to 5 feet in thickness of fire clay. This out-crop is of the first coal seam over the *Upper Conglomerate.* This same coal seam crops out in the S. W. ¼ of S. W. ¼ of S. 22, T. 11, R. 1 W., in the road to Chamblee's Mill, some 20 feet over the Upper Conglomerate. The coal smut of this out-crop is from 8 to 10 inches thick and is over a thick bed of fire clay. The dip here is about 45° to the N. W. At Chamblee's Mill, in the northern part of S. 21, T. 11, R. 1 W., there are some false-bedded

strata. On top of the mountain in S. 14, T. 11, R. 1 W., there is a pond or sink.

In a whirl pool or deep hole in the river in the southern part of S. 28, T. 9, R. 1 E., there is said to be an out-crop of a seam of coal. It is the seam just under the *Upper Conglomerate* which crops out in a bluff along the river. The dip here appears to be a few degrees down the river or to the south-west, and a little greater than the fall in the river. The mountain along here has a very perceptible basin area as seen from the south-east crest. Just to the south-east of this crest and near the top of it, or just under the Lower Conglomerate or Millstone Grit that forms the crest, there is in the S. E. ¼ of S. W. ¼ of S. 2, T. 10, R. 1 E., an out-crop of white plastic fire clay, that has been dug from open pits and worked up into jugs, jars, etc. Only the better portion of this clay, or that which is free from grit, is used. Near these diggings, there was dug by employees of the B. M. R. R. into this clay a pit of which the following is a section as given in their note book:

TEST PIT NO. 2, S. ½ of S. W. ¼ of S. 2, T. 10, R. 1 E.

Conglomerate.
Slaty clay.
COAL, 4 in.
Fire clay, 14 in.
Clay (sandy), 10 in.

The conglomerate of this pit, as has been stated, is the *Lower Conglomerate.* The dip here is about 30° to N. W.

Some three fourths of a mile to the north-east, or about one-half mile to the north-west of Summit, there occurs the following section, as given in the report of the B. M. R. R.

Conglomerate.
Slaty clay, 12 in.
Fire clay, 51 in.

In the Blountsville road just south of Summit, the Lower Conglomerate dips about 45° to the N. W. The strata, however, here at Summit, along the south-east edge of the mountain, are in long deep waves or wrinkles from N. W. to S. E. Summit is in the trough of the greatest or most south-eastern of these waves or wrinkles, which, here at Summit, is some

350 yards broad from crest to crest, and about 125 feet deep from top of crest to bottom of trough. These waves appear to disappear rapidly to the north-west, or as you go away from the edge of the mountain or the anticlinal valley. There is here at Summit something like the following section:

SUMMIT SECTION, IN S. 36, T. 9, R. 1 E.

(14) *Shales, Sandstones;* some of the shales are hard and ferruginous and some of them are clayey or argillaceous and of a light gray color; the sandstones are shaly and slabby. These strata cap the high point one-half mile north-east of Summit, 20 ft.
(13) *Upper Conglomerate;* about 15 ft.
(12) COAL; at chalybeate spring on side of above high point and also reported to be in the gin-house well, at Summit, where it is said to be of poor quality, but about 2 ft. thick; 2 ft.
(11) *Fire clay;* in above chalybeate spring.
(10) *Shales, Clay-iron-stone;* the shales are arenaceous and have in them fossil plant impressions and streaks, from two to three inches each in thickness, of clay ironstone, 25 ft.
(9) *Lower Conglomerate;* about 25 ft.
(8) *Clay-iron-stone;* shaly on top with plant impressions, 1 ft.
(7) *Fire clay,* 4 ft.
(6) COAL, 2 in.
(5) *Fire clay,* 3 ft.
(4) *Debris,* 5 to 6 ft.
(3) *Shale, Clay iron-stone;* the clay-ironstone is in streaks in the shale, 3 ft.
(2) *Quartzite;* very hard, 10 ft.
(1) *Debris;* covering the lowest strata of the Coal Measures and the uppermost sub-carboniferous strata.

From (1) to (9) inclusive crop out along the Warrenton road just east of Summit. A pit was dug into the strata just under the Lower Conglomerates by the employees of the B. M. R. R., and the following section given by them.

Conglomerate.
Manganese Iron Ore, 5 in.
Clay and Slate, 8 in.
COAL, 2 in.
Fire clay, 4 ft.
Sandy clay, 1 ft.
Yellow slate, 6 ft.

The dip heie is from 12° to 30° to the N. W.

On the Huntsville road about 2 miles north of Summit is a pond; and on Price's Creek, in S. 6, T. 9, R. 2 E., there is the following out-crop :

OUT-CROP ON PRICE'S CREEK, IN S. 6, T. 9, R. 2 E.

(5) *Shales, Sandstones.*
(4) COAL, BLACK BAND ORE; the *coal* is variable and is in places an impure *black-band* ore, 6 in.
(3) *Shales;* hard, 2 in.
(2) COAL; very impure, cubical, 4 in.
(1) *Clay.*

11.—THE COAL MEASURES OF ST. CLAIR COUNTY.

The Coal Measures of St. Clair county are of the Warrior, Cahaba and Coosa Coal Fields and cover nearly 225 square miles.

A.—The Warrior Coal Field.—The Coal Measures of the Warrior Coal Field in St. Clair county comprise the elevated south-east border and the steep south-east side of Blount Mountain and the whole of Chandler Mountain. The north-west boundary line of the county is the divide between the waters that run into the Warrior River and those that run into the Coosa River, along the elevated south-east brow of Blount Mountain. The Coal Measures of this mountain that are in St. Clair county are therefore principally on the south-east side of the mountain, which is formed by the hard conglomerates near the base of the measures. They lie therefore between and below these conglomerates. A general section of these measures is given in the lower part, the portion below the Second or Upper Conglomerate, of the general section of the Coal Measures of Blount Mountain. See Section 2. From that section it can be seen that these measures are about 1200 ft. in thickness. They include, according to Gen. Gibson, 6 seams of coal of over 1 ft. each in thickness. The two upper seams are over 3 ft. each in thickness. That section also shows that the sub-conglomerate measures are very highly developed, that they are over 600 ft. in thickness and include four of the above seams of coal. The structure of these measures, their general dip to the north-west, is seen at the south-east end of the graphic section across Blount Mountain as given in *Section 2*.

Chandler Mountain is nothing more than a detached part of Blount Mountain. It is separated from Blount Mountain by *Greasy Cove* which is the south-west end or head of Big Wills Valley. Big Wills Valley is an anticlinal valley and the unbroken or undenuded fold of this valley is said by Gen. Gibson to extend to the south-west of the head of Greasy Cove as a prominent ridge, called Buck's Ridge, on Blount Mountain. This ridge or undenuded portion of the fold is said to to extend to the south-west of the head of Greasy Cove to the end of Blount Mountain, a distance of some 20 miles.

Chandler Mountain at its south-west end or at the head of Greasy Cove is connected on to Blount Mountain by a high gap of the uppermost sub-carboniferous rocks or of Mountain Limestones, the Coal Measures of the two mountains being entirely disconnected or removed by denudation from over this connecting link. Chandler Mountain is a long narrow mountain with a north-east and south-west trend. It is some 8 miles long with a width of from 1 to 1½ miles, and an area on top of some 10 square miles. It has precipitous sides that are capped with a high bluff. Its summit is from 900 to 1000 ft. above the adjacent *flat woods* of the Coosa Valley. It is a shallow synclinal trough and is made up almost wholly of Coal Measures, the sub carboniferous strata cropping out low down on the sides of the mountain. The Lower Conglomerate or Millstone Grit forms the high capping bluff around the brow of the mountain and, according to Gen. Gibson, is in this mountain from 80 to 100 ft. in thickness. It also, according to Gen. Gibson, is the surface rock of the top of the mountain except up near the north-east end where there is a basin with higher strata carrying two seams of coal. These two seams of coal, he says, have been worked in S's 27 and 28, T. 12, R. 4 E., but now the pits are filled up and the character of the coals in them can not be seen. These coals, however, as he says, can be seen in the S. W. corner of S. 33, T. 12, R. 4 E., where they have also been dug into. Here the upper seam is a soft impure coal of about 2 ft. in thickness,

of little value; and the lower seam, 40 ft. under the upper one, is in two benches of from 12 to 14 inches each in thickness that are separated by from 8 to 24 inches of slate. These two coal seams, he says, are in loose friable sandy strata. They most probably correspond to *Coals* (5) *and* (6) of the General Section on page 192.

The Coal Measures under the capping bluff of Millstone Grit, or the sub-conglomerate measures, are in this mountain highly developed. They must be some 700 feet in thickness. They carry, according to Gen. Gibson, four known seams of coal. These seams, he says, on the out-crops, are thin, but have never been thoroughly tested. The uppermost seam, which is just under the capping bluff of *Millstone Grit*, is said to be on the south-east side of the mountain near Mr. Jehu Stephens, about 18 inches thick on the out-crop. The next seam, which is placed about 150 feet under the uppermost one, is given a thickness on the out-crop of about 1 foot; and the next, or third seam from the top one, is said to be probably about 100 feet still lower: its thickness is unknown. The bottom seam is reported to be at the base of an immense bed of slate, and to be too thickly covered by debris to see its thickness. These four sub-conglomerate coal seams doubtless correspond to the four lowest coal seams of the General Section on page 192.

B. Coal Measures of the Cahaba Coal Field in St. Clair County.—These measures embrace the north-east end of the Cahaba Coal Field and cover an area of about 50 square miles. Being near the line of greatest disturbance of the great Appalachian revolution, their strata have been very much disturbed, and so they now form a broken country. Their area is bounded on the north-west, and partly on the north-east, by a bluff and high rim of Millstone Grit, and on the south-east by a great fault that brings Cambrian strata in contact with them. Along this fault the vertical displacement of strata is 10,000 or more feet.

The prevailing dip across the entire width of the field from the north-west edge to the perpendicular strata along

the south-east boundary fault is to the south-east and hence the field is practically a monoclinal basin. The dip varies from 6° to 8° of the Millstone Grit along the north-west edge to 65°, 80° and to even a perpendicularity along the south-east edge. Locally, however, from folds in the strata, the dip is frequently to the north-west. The prevailing dip around the high north-east rim of the field is towards the coal field or to the south-west, and so a basin shape is given to this end of the field. As the prevailing dip across the entire width of the field is to the south-east, and as this dip is much greater than the inclination of the surface, the measures must of course thicken in this same direction and be thickest along the south-east edge of the field. These thickest measures in St. Clair county, as reported by Mr. Joseph Squire, M. E., are about 4,350 feet thick, and have 17 seams of coal that range in thickness from 6 inches to 11 feet 6 inches, with an average combined thickness of near 50 feet of coal. Of these 17 seams, 10 have an average of two feet and over each in thickness of coal; of these 10 seams, 7 have an average of 3 feet and over each in thickness of coal; of these 7 seams, 3 have an average of 4 feet and over each in thickness of coal; of these 3 seams 2 have an average of 5 feet and over each in thickness of coal, and of these 2 seams one has an average of over 10 feet in thickness of coal.

These coal seams, from their steeper dip, crop out in much narrower areas than do those in the Warrior Field, and for this same reason are much less above drainage level than those of that field. Most of the coals of these seams are reported to have a bright and shiny luster and to be remarkable for their pureness and dryness.

A report on the Cahaba Coal Field, and a map of the field, by Mr. Joseph Squire, M. E., Assistant Geologist, in charge of the Cahaba Coal Field, has lately been published by the State Geological Survey. The map is a most handsome piece of work; it is the work of a life-time, as it has been prepared from surveys made during the last 30 years. It shows the topography of the field, the division of the field

into different coal basins, the larger faults of the field, the lines of out crops of the different seams, etc., etc., etc. It shows, in graphic sections across different portions of the field, the structure of the field; and, in vertical sections, the thickness of the measures, the coal seams in their proper positions, etc., etc., in different portions of the field.

To this report and map, by Mr. Squire, the reader is respectfully referred for a detailed description of the Coal Measures of the Cahaba field in St. Clair county.

C. COAL MEASURES OF THE COOSA COAL FIELD IN ST. CLAIR COUNTY.—These measures comprise the north-east half of the field, about 145 square miles. The limits of this field can be marked out with tolerable accuracy, but comparatively little is known of its interior. The north east end of the field is in Calhoun county, about one mile to the east of the Coosa river, the county line. It resembles the Cahaba Coal Field in that it is a long, narrow field, with a north-east and south-west trend. The portion within this county is near 35 miles in length and has a maximum width of only about 6 miles. It is bounded on the north-west and north-east by a high bluff and rim of Millstone Grit, the *Lower Conglomerate* of Safford, and on the south-east by a fault in a comparatively low country. This fault is much smaller than the one along the south-east edge of the Cahaba field, as the lowest rocks along it, to the south-east of it, are of the Trenton Group. The prevailing dip across the entire width of this end of the field is to the south-east. It is from 45° to 35° to the south-east along the north-west and gradually diminishes to the south-east to that of only 15° to 12° to the south-east near the fault along the south-east edge of the field, where it suddenly becomes steep, or more than perpendicular from the strata having been pushed over to the north-west until the bottom ones are on top and have a dip of 75° to 80° to the south-east and more. This end of the field is therefore in appearance a monoclinal basin, though in reality it is an irregular synclinal with the axis along near the south-east edge of the field. See Section 2.

The strata of this field have been greatly disturbed and hence are probably badly faulted. As the prevailing dip is to the south-east, the thickest measures are of course near the south-east edge of the field. These thickest measures are something like 2000 feet in thickness and are said to have three workable seams of coal that range in thickness from 3 to 4 feet. They are believed to be very variable in thickness and in many places in this county too thin to be worked. They have been mined however for a great many years at Ragland and Broken Arrow. The coal appears to be rather friable or soft for stocking purposes but well suited for coking. There are other seams of coal in these measures, both above and below the three workable seams mentioned, but they are believed to be too thin to be of any commercial value.

A seam of coal, reported 3 ft. in thickness, was struck in the Coosa River in blowing out the channel to Lock No. 2, in the S. E. corner of S. 24, T. 14, R. 5 E. There are said to be out-croppings of coal in the S. E. ¼ of S. 9, T. 15, R. 5 E.; in the S. E. ¼ of S. 7, T. 15, R. 5 E.; in the N. E. ¼ of N. W. ¼ of S. 7, T. 16, R. 4 E.; in the N. E. ¼ of N. E. ¼ of S. 1, T. 16, R. 3 E.; in S. 14, T. 17, R. 2 E.; in the S. W. ¼ of N. E. ¼ of S. 27, T. 17, R. 2 E.; and in the N. W. ¼ of S. E. ¼ of S. 33, T. 17, R. 2 E. The coal in the S. W. ¼ of N. E. ¼ of S. 27, T. 17, R. 2 E. is about 8 inches thick; it is soft and is good for coking and blacksmithing purposes. It is just under a soft black smut about 2 ft. in thickness.

In the railroad cut about one-half mile west of Eden on the G. P. R. R., the strata, shales and sandstones, gradually curve from a dip of about 85° to S. E. on the out-crop to that of about 70° to S. E. at the bottom of the cut some 30 ft. deep. They are also in small waves or wrinkles. The dip gradually becomes less steep to the west or north-west until a fault is struck, within a short distance, near the western end of the cut.

12.—THE COAL MEASURES OF SHELBY COUNTY.

The Coal Measures of Shelby county comprise about 240 square miles and are embraced in the Cahaba and Coosa Coal Fields.

A.—THE COAL MEASURES OF THE CAHABA COAL FIELD IN SHELBY COUNTY.—These measures cover about 130 square miles. They embrace the broadest portion, about 15 miles in width, and hence the thickest measures and all of the coal seams in the Cahaba Field. The county line on the north-west for some 12 miles or more is along the top of the high rim of *Millstone Grit* of the north-west edge of the coal field. The surface of these measures is broken and conforms strictly to the geological structure of the country. Ridges and valleys have been formed to run with the general strike of the strata in a north-east and south-west direction; the ridges being of the out-crops of the harder strata and the valleys of the out-crops of the softer strata. The thickest measures are along the south-east edge of the widest portion of the field, because the prevailing dip across the entire width of the field is to the south-east. The dip gradually changes from 6° to 8° to S. E. of the Millstone Grit along the county on the north-west to that of being almost flat near the center of the field and then, in places, suddenly changing to a very steep dip to the south east along the south-east edge of the field near the great boundary fault.

The thickest of these measures, according to Mr. Jos. Squire, M. E., are estimated at over 5,000 ft. in thickness and have 49 seams of coal with an average combined thickness of coal of near 100 ft. Of the 49 seams of coal, 19 have an average of 2 ft. and over each in thickness of coal; of these 19 seams 11 have an average of 3 ft. and over each in thickness of coal; and of these 11 seams 3 have an average

of 5 ft. and over each in thickness of coal. These coals have the disadvantages of being in a broken country and in many places of being highly inclined and doubtless badly faulted. As a general thing, they are comparatively pure, hard and dry coals, with a bright and shiny luster.

For a detailed description of these measures and their coals, the reader is respectfully referred to the late report and map on the Cahaba Coal Field by Mr. Jos. Squire, M. E., Assistant Geologist in charge of the Cahaba Coal Field.

B.—COAL MEASURES OF THE COOSA COAL FIELD IN SHELBY COUNTY.—These measures embrace about 110 square miles. They are in the south-west end of the field and are of two separate or distinct parts of almost equal areas. (See map.) The south-eastern of these parts is cut off from the other part, or from the south-west end of the main field, by a fault and a narrow monoclinal valley of sub-carboniferous strata to the south-east of the fault. The north-west part or the portion of the main field in this county embraces some 60 square miles while the south-east part or the *cut-off strip* has in it about 50 square miles. Both of these parts are bounded on the north-west by high rims and bluffs of the *Millstone Grit* which round off their south-west ends. They both form a broken country that presents many wild and picturesque scenes. Their strata have been very much disturbed and hence are doubtless badly faulted. In both parts, the prevailing dip of the strata is to the south-east, and so their thickest measures are near their south-east edges. These strata are principally of the hard weather resisting strata near the base of the measures, mostly conglomerates and sandstones, and over much the greater parts of both areas are less than 600 ft. in thickness. Both of these parts however have a maximum thickness of Coal Measures of perhaps 2000 ft. and more.

The north-west part for some 10 miles to the north east from its south-west end is bounded on the south-east by a fault, and is made up of highly tilted strata that are badly

faulted. The rest of this part to the north-east, to the county line, a distance of some 15 miles, is an irregular synclinal trough with the bottom or axis of the trough near its south-east edge and the strata to the south-east of the axis, or near the boundary fault on the south-east, very highly inclined to the north-west. The boundary fault along here is in places in sub-carboniferous strata just to the south-east of the Coal Measures. In a portion of this irregular synclinal trough, there is along the south-east edge a high anticlinal ridge with a broad arch.

The strata gradually flatten from a dip of 30° to 70° to the S. E. of the conglomerates along the north-west edge to the bottom of the trough and then suddenly rise to a dip of from 30° to 80° to the N. W. This part has at least three seams of coal, but they are believed to be too thin and variable to be of any commercial value. Two of these seams, however, are said to measure in places, respectively, 2 feet and 4 feet in thickness. The south-east part, or the *cut off* slip, is some 25 miles long. From its south-west end for about 8 miles to the north-east, to a cross fault, it is about four miles in width and is an irregular broken synclinal trough that is bounded on the north-west, south east, and south-west by a high rim and bluff of *Millstone Grit.* The rest of this south-east part, the portion to the north-east of the cross-fault, is about two miles in width and is a monoclinal basin that is bounded on the north-west and north-east by the high rim and bluff of Millstone Grit, and on the south-east by a fault in a comparatively low flat country. This boundary fault appears to continue to the south-west of the cross fault through the irregular synclinal basin, though with a diminished displacement of the strata along it. This south-east part is scalloped or notched in its broad south-west end where the above boundary fault is supposed to come out.

There are in this south-east part four known seams of coal. They vary very much in thickness and as a general thing are believed to be too thin to be of any value, though the uppermost seam in an out-cropping in the N. E. ¼ of N. W.

¼ of S. 4, T. 20, R. 1 W., is from 9½ to 10 feet in thickness, without any partings, and the one next to the bottom in an out-cropping in the N. W. ¼ of N. W. ¼ of S. 27, T. 19, R. 1 W. has the following section:

OUT-CROPPING IN THE N. W. ¼ of N. W. ¼ of S. 27, T. 19, R. 1 W.

(9) *Shale;* cover.
(8) COAL, 5 in.
(7) *Slate*, 2 in.
(6) COAL, 16 in.
(5) *Slate*, 2 in.
(4) COAL, 24 in.
(3) *Slate*, 2 in.
(2) COAL, 4 in.
(1) *Shale;* underbed.

This out-crop is so badly weathered as to tell nothing as to the quality of the coal. The dip is 50° to 60° to S. E. About 15 feet over this seam of coal there is said to be a clean seam of coal from 2 feet 6 inches to 3 feet in thickness.

The coal of the uppermost seam, in the above out-crop, is very soft and is of a peculiar laminated structure. It is so soft as to be easily hid on the out-crop and is doubtless a good blacksmithing and coking coal. The underbed is a soft argillaceous shale and the cover is a hard reddish shale. The dip is about 50° to the S. E.

The lowest of these seams, which is under the *Millstone Grit*, is said to have been dug into in the N. E. ¼ of S. 4, T. 19, R. 1 E., and in the N. E. ¼ of S. 35, T. 18, R. 1 E., and it is said to be from two to over four feet in thickness. In the potter's clay diggings, just under the Second or *Safford's Upper Conglomerate*, in the S. W. corner of S. E. ¼ of N. W. ¼ of S. 36, T. 18, R. 1 E., there are some thin streaks of coal. This clay, when thoroughly wet, is very plastic, and is well suited for making jugs and common pottery, for which purposes it is extensively used.

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COAL MEASURES OF COUNTIES.

MARSHALL COUNTY—Continued.

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GEOLOGICAL SURVEY

—OF—

ALABAMA.

EUGENE ALLEN SMITH, PH. D., STATE GEOLOGIST.

REPORT

ON THE

GEOLOGICAL STRUCTURE OF MURPHREE'S VALLEY,

—AND—

ITS MINERALS AND OTHER MATERIALS OF ECONOMIC VALUE.

BY

A. M. GIBSON,

ASSISTANT GEOLOGIST.

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To His Excellency, Thomas G. Jones,

Governor of Alabama:

SIR—I have the honor to submit herewith the Report of A. M. Gibson, Assistant Geologist, upon Murphree's Valley. From the preface it will be seen that this report was in great part written several years ago. The delay in the publication has come from several causes, chief among which was the lack of a suitable map to illustrate it. The general geological map of the state being at the time of the writing of this report in course of construction, it was thought better to use that in illustration than to duplicate a part of it for this special purpose. Every one who has had experience in such matters will readily understand how the completion of such a map as that of the state of Alabama has taken far more time than was anticipated at the outset.

The present report deals with the geological formations of the valley alone; other reports of Mr. Gibson have been published, treating of special areas of the Coal Measures adjacent to this valley, and one is now in course of preparation describing in detail the Coal Measures of Blount Mountain lying to the east of Murphree's Valley.

Very respectfully,

EUGENE A. SMITH,

State Geologist.

University of Alabama, Dec. 27, 1892.

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PREFACE.

In the following Report that part of the great Jones Valley, or Birmingham fold, lying in the counties of Blount and Etowah, is specially presented.

The geological reconnoisance on which it is based was made several years ago, when the mineral contents of the region were wholly undeveloped. Average, or fairly representative samples of all the ore beds, or in most of the mineral area, could not then be obtained. To avoid the appearance of giving undue prominence to certain places, and too little to others, of favoritism or partiality, it was deemed fairer to all sections and parties to make no analyses of special samples, but to subject all alike to the same judgment of quality, and approximate per centage of metal.

Since the text was written iron ore mines, and limestone quarries have been extensively worked near Village Springs, the Compton Mines; and brown ore, near the middle of the valley, the Champion Mines; building rock quarried near Oneonta, and red ore mined at DuBois Station; in each of these places the estimate of quantity and quality of the ore, as given in this report, has been fully realized, and more than realized in the quality of the limestone and building rock. It is, therefore, with increased confidence in its general correctness that this brief sketch is submitted to the public.

Chepultepec, Ala., June, 1890.

MURPHREE'S VALLEY.

LOCATION AND AREA.

This valley is the north-eastern prolongation of Jones' Valley. It bears the name Murphree's Valley (from its earliest white settlers) through Blount county, and up to where the Locust Fork of the Warrior crosses it, in Etowah county. From the Warrior to its upper end it is called Bristow's Cove. The term "cove," however, is not properly applied here. It is not a cove, such as is usually designated by that name, but a portion, the upper end, about twelve miles in length, of this long, narrow valley. It presents throughout its whole length the same geological and topographical features, and must, therefore, be considered accordingly, without reference to local names or subdivisions.

The entire length of this fork of Jones Valley from the county line between Blount and Jefferson, at Village Springs, to its upper end, is about 32 miles, on a direct line. Its usual breadth is from three to five miles. Its narrowest portion is near its junction with Jones Valley; thence northeastwardly it gradually widens, and in ten or twelve miles it has reached its maximum width, which it generally preserves till its abrupt termination in the Raccoon Mountain.

Its trend or course is nearly, but not quite, identical with the axis of Jones' Valley. The latter bifurcates* at the south-

*Mr. Gibson uses the name Jones' Valley to designate the entire valley area separating the Cahaba and Warrior Coal Fields below Village Springs. This area, however, is in its structure a double anticlinal fold with synclinal ridge between them. Both the folds have been overlapped towards the northwest, and each has a fault close to its western border and approximately parallel thereto. Erosion has formed a valley out of each of the

western end of Raccoon or Blount Mountain, as it is here called; one branch deflecting eastward joins the Cahaba Valley, the other a little westward of the course of its former axis, makes Murphree's Valley. Just as a stream divides around an island, has the axis of Jones Valley here divided and deflected to the right and left around the point of the mountain.

The trend of the axis of the Murphree's Valley fold for a few miles above the bifurcation is N. N. E. From the Blackburn Fork of the Little Warrior to the Calvert Fork, it is due N. E. From the Calvert Fork to the upper end it gradually becomes more and more E. N. E, deviating, however, in its whole length only two miles from a due N. E. and S. W. line.

DRAINAGE.

To an observer it seems a singular fact that all the principal streams of this valley flow across it; that they flow out of the valley and on to the mountain, as the Coal Measures are generally called. This fact is easily explained. This valley is emphatically a *valley of elevation*. And though it has been scooped out by water, and denuded down to the

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anticlinals—Jones' Valley on the east, Opossum Valley on the west,—while the synclinal between them, in the vicinity of Birmingham, appears in the Chert ridge of the North Highlands. Murphree's Valley is, therefore, the extension northeastward of the westernmost of the two sub-valleys named, i. e., Opossum Valley, while Jones' Valley proper passes towards the northeast into the Great Coosa Valley about Springville.

From the latitude of Village Springs, northeastward the synclinal separating these two folds, is considerably wider than is the case near Birmingham, and includes strata as high up in the geological series, as the Coal Measures. As far south as this synclinal has Coal Measures for its surface rocks, it is known as the Blount Mountain, ending near Village Springs. Below this, towards the southwest where the surface rocks are chiefly the cherts of the Knox Dolomite, with occasional traces of overlying strata up to Clinton, the synclinal so far as I know has no distinctive name beyond the general one of Flint Ridge, till in the vicinity of Birmingham, it has recently been called the North Highlands. See map section in appendix to Squire's Report on Cahaba Coal Field. E. A. S.

lower Silurian and Cambrian formations, yet its floor is from *one to two hundred feet higher* than the synclinal trough in the COAL MEASURES, near its N. W. side, in which the Warrior rivers flow. Another fact must also be noticed in this connection. This valley has no synclinal depression *belonging to its fold* on the S. E. side. That side is much higher than the floor of the valley, and slopes toward it; hence the streams which rise on that side run into, and across the valley, and out through its north-western rim into the low lying synclinal trough, between this and the Sequatchie fold. A profile view would present this as a great valley scooped out along the side of a long north-west slope; one of nature's immense, but now disused, hillside ditches, which once perhaps answered the purpose of drainage, but now offers no impediment to the streams flowing across it from the Raccoon Mountain. The breadth of this slope is from 15 to 20 miles. Its highest part is the eastern top of the Blount Mountain, or western rim of the great Cahaba and Coosa folds. The average declination throughout this distance is about 25 feet to the mile. The fall of streams before they reach the valley, and after they leave it, is very great, affording many fine mill-seats and ample water power for industrial machinery.

The only exception to the course of the drainage across the valley is in that part lying north-east of the Locust Fork of the Warrior, known as Bristow's Cove, in which the streams rising in the valley flow down it about 10 or 12 miles to the Warrior River. In this upper part of the valley, and in the long mountain north-east of it, extending along the north-western side of Wills' Valley, the slope of the country seems to be to the south-west, as the streams all flow in that direction, along the margin of Wills' Valley, thence gradually changing into a north-western course to the Tennessee river.

TOPOGRAPHY.

The topographic features of Murphree's Valley are in large measure determined by the quality and altitude of the strata out of which the valley has been excavated. It may, therefore, be well to introduce here a table showing the order of succession of the geological formations concerned in the structure of this part of the state, together with the thickness of the several divisions, and the lithological characters of the principal strata of each.

Under appropriate heads below will follow further details concerning these formations.

TABLE OF THE PALEOZOIC FORMATIONS OF ALABAMA,

Which take part in the structure of Murphree's Valley, with the thickness of each in and adjacent to the Valley.

Period.	Formation Name.	Thickness.	Tennessee Equivalent.
Carboniferous...	Coal Measures: Sandstones and conglomerates............	100 feet and upwards...	Coal Measures.
	Mountain Limestone (Bangor)	200–300......	Mountain Limestone.
	Lagrange or Oxmoor Sandstone......	80–100......	
	Siliceous Group or Fort Payne Chert......................	200..........	Siliceous Group.
Devonian......	Black Shale...	10–40.......	Black Shale.
Silurian	Clinton or Red Mountain Sandstones and Shales...........	150...........	Dyestone Group.
	Trenton and Chazy: Pelham Limestone	250...........	Trenton and Nashville.
	Knox Dolomite: Cherty..................................	1,200–1,500...	Knox Dolomite.
Cambrian.	Sparry Limestone: Coosa Shale..........................	1,200.........	Knox Shale.

The topographical features of this valley differ slightly, though not essentially, from those of Jones' Valley. The longitudinal ridges are more distinctly marked, and more persistent. The Red Mountain occupies a more central position, being near the middle of the valley, and the Carboniferous or Mountain Limestone is much more extensively exposed on the north-west side. The structure of the fold is different, but the formations exposed are precisely the same.

The prominent longitudinal ridges divide this valley into several sub-valleys. These are called by different names respectively, and present different features. No two of them can be distinctly seen at once from any standpoint. It is therefore necessary to examine them all consecutively to get a clear knowledge of Murphree's Valley.

Sand Valley.—The first of these sub-valleys on the north-west side is called *Sand Valley.* It has the coal measures of the Warrior Coal Field for its north-western margin. Below the coal measures, at the base of Sand Mountain, as it is called, the carboniferous or mountain limestone is largely exposed. But the most prominent rock in it is the Oxmoor or Lagrange Sandstone, the disintegration of which has given it a sandy soil, and large accumulations of sand; hence the name, "Sand Valley." The Red Mountain, with its base covered with sub-carboniferous cherts, makes its south-east margin.

This valley is often narrow, but where it is traversed, or crossed by a stream, it contains good bodies of land. Towards the upper and lower ends of this valley it has its most continuous wide belts of arable soil, and many good farms.

The Central Valley.—The Red Mountain, the most prominent and persistent ridge of this valley, separates the Sand Valley from the central or middle sub-valley. It is locally known as "Red Mountain Valley." It is of varying width, but is generally the broadest and most important of the sub-valleys. On the side next to Red Mountain it has a rich, dark red soil mainly derived from the iron ore and limestone

of the mountain, the debris of the Clinton and Trenton rocks. The other side is mainly the detritus of the Lower Silurian Cherts.

The Eastern Valley.—Broad massive ridges mostly of Lower Silurian Cherts, partly of Cambrian Limestone, separate the Red Mountain Valley from the next valley on the south-east, as far up as they are separated. This dividing ridge is very prominent from Village Springs to the Champion Mines, a distance of fifteen miles. Farther up the valley it becomes more knobby and less prominent, and entirely disappears a little above the south-western line of Etowah county. Above this, for ten miles or more, both of the sub-valleys south-east of Red Mountain are merged into one. Near the upper end of the valley, however, the division between the two sub-valleys is again established by a ridge of lower Silicious (Fort Payne) Chert, which gradually rises up a little beyond Aurora P. O., and increases in height as it curves round the upper end of the Red Mountain Valley and joins there with the curved end of Red Mountain.

The sub-valley lying on the south-east side of Murphree's Valley has no distinctive name. It might be called the Limestone valley, or the Cambrian valley, as all the exposures of the Cambrian limestone of this region are in it, and for fifteen miles above Village Springs this valley has been mainly scooped out of, and is floored with that rock; but neither of these names would properly designate its upper part. It will be properly referred to as the eastern or south-eastern sub-valley. It has generally a good soil, and contains many good farms. The south-eastern side of it is generally very broken, with ridges and knobs of Clinton and Sub-Carboniferous strata. These are very irregular in outline, and as their strata dip at high angles, they are generally steep.

Straight Mountain.—Immediately adjoining these ridges and knobs on the south-east side is a high ridge of Carboniferous rocks, all nearly to quite vertical, and 300 to 400

feet high above the floor of the valley, and from 100 to 200 feet above the general level of the Coal Measures beyond. This ridge is very narrow, the breadth of its base at the level of the valley being only 600 to 700 feet. The sides very steep, yet smooth; the top sharp backed, scarcely a rod in breadth, yet of almost uniform height. Denudation has had but little effect on it. No wind gaps, or gullies, or areas of abrasion are seen. Its symmetry is unbroken, save where the streams rising in the mountain beyond have cut their way through it into the valley below. The channels of drainage here have evidently not been changed since they were first established.

The height and volume of this vertical ridge, or wall, are nearly uniform for long distances, and it seems to be exactly parallel with the axis of the valley. This remarkable topographical structure is the south-eastern edge, or rim of Murphree's Valley, and bears the local name of *Straight Mountain.*

The vertical portion of this marginal rim gradually diminishes in prominence toward the ends of the valley. Its greatest elevation and volume being opposite that part in which the Cambrian limestone is exposed; that is from a little below Remlap, for fifteen miles north-east to a little above the Champion Mines.

Near the upper end of the valley the vertical rocks are not seen; apparently they have passed beneath the surface, and the rim or edge of the valley is the face of the Coal Measures, dipping for a short distance to the south-east, at an angle of about 60°.

Red Mountain.—This most important topographic as well as economic feature of the valley lies generally to the west of the central line of the valley, but near its head the Red Mountain is about equi-distant from the two margins of the valley. It is made up usually of three formations—the Clinton, the Black Shale and the lower member of the Sub-Carboniferous. In many places a fourth underlying formation, the Trenton, is found along the inner or valley side of the Red Mountain, extending in some cases almost or quite

to its summit. In this case the other formations named extend along the outer or western slope of the mountain. On account of the red iron ores which it contains, the Red Mountain will be described in detail below, and further mention here is unnecessary.

Sand Mountain.—The north-west side of the valley also has an elevated rim called "Sand Mountain." Often the whole of the Coal Measures lying west and north-west of this valley are also called Sand Mountain, but the only portion of this region that is much elevated, and presents a mountainous character, is the elevated rim of the valley, which, when seen from a distance, is always especially called the "Sand Mountain." This elevated rim extends the whole length of the valley, and is usually 300 to 400 feet high above the floor of the valley. Its strata are the lower portions of the Carboniferous, consisting of lower Coal Measures in its upper part, and the upper part of the Sub-Carboniferous or mountain limestone at the base. The dip of the strata here varies but little from 15° to the north-west.

While this rim has about the same elevation as the one on the south-east side, it presents very different features. On the side next the valley it is irregular in its slope, rough and rocky, with many slides and benches, deeply gullied and indented, showing throughout the wear and tear of erosion. The top is not uniform in outline or elevation. The trend only approximates the direction of the axis of the valley; this however is largely due to its great but unequal erosion on both sides. On its top, and beyond, it shows much evidence of denudation, large areas of bare rock, often lower conglomerate are exposed. Its slope north-west for two to three miles to the synclinal trough in which the Warrior river flows is gentle, and gradually diminishing.

It has been suggested as probable that the courses of the streams, and the direction of the drainage here, have been changed by the uplifting fold of the valley. In support of this view it is urged that the rising fold across the course of the streams must necessarily have deflected them into new

channels, if not into new directions. But admitting that the direction of drainage has not been materially changed, it is urged that the deep canon-like gorges, in which the streams flow through the Sand Mountain, are apparently of more recent origin than their channels on the other side of the valley. The evidence of the apparently greater age of the stream channels on the south-east side of the valley consists in their greater general breadth, and in the considerable amount of bottom lands that exists along them; while on the north-western side no bottom land exists along their narrow channels from the edge of the valley till they reach the synclinal.

These facts are apparent, and would usually be persuasive, if not conclusive of the subject. But here, with the changes of levels produced by the rising fold, they may have originated from other causes than difference in age. It has already been stated that this Sand Mountain rim has been greatly denuded. Before its elevation, the channels of the present streams (if then existing) must have been several hundred feet above their present beds. With the rising rim the ancient flood plains would be washed away, and the streams would cut down their channels deeper and deeper, as elevation progressed. Hence, on the theory that the drainage here was established before the fold began to rise, it does not necessarily follow, from the observed facts, that the course of the streams was thereby materially changed. But it might also be assumed that the rising of this fold, and the rising of this region above the waters, and the establishment of its drainage were all synchronous events, and that they proceeded and progressed *pari passu.* Upon this hypothesis the deep narrow gorges cut by the streams through Sand Mountain, would be accounted for by the greater depth they had to be excavated. While above and below, the streams were widening their flood plains; here their whole force was expended in cutting down their beds. Without endorsing either hypothesis, it is sufficient for the present purpose to present the facts as stated.

Other topographical features being closely connected with

the geological structure, will be more clearly presented in the progress of its structural description. It will be understood from what has been stated that all of the sub-valleys described, with the intervening marginal ridges, make up and constitute Murphree's Valley. That it is environed by Coal Measures, except on the south-west end; and that these measures adjoin or abut against the valley in an elevated rim on both sides.

GEOLOGICAL FORMATIONS.

On a preceding page we have given a table of the Geological Formations exposed in Murphree's Valley. It is necessary, for the proper understanding of much that follows, that we should now describe these formations in some detail. In this description they are considered in descending order:

Carboniferous.

1. Coal Measures.

The coal measures cover the surface on both sides of this valley. On the north-west side they are thin; rarely exceeding 100 feet at the edge. Only the base rocks have been left. The lower conglomerate is generally the crest of the valley rim. On a portion of the opposite side these measures are known to be over 2,000 feet thick. Nearly this depth of strata has therefore been washed away from the top of the north-western rim. The measures, however, rapidly deepen towards the north-west. The dip of the strata in that direction is about 15°. The lower conglomerate rock here, as elsewhere, is from 80 to 100 feet thick. In its lower part it is often strictly conglomerate, wholly composed of pebbles, firmly cemented together with silica, or silica and iron.

Generally the pebbles are small, white and well rounded. Occasionally more angular fragments, and pieces of carbonate of iron, form a breccia. In other parts the pebbles are irregularly scattered, or occur in patches and irregular streaks. A large portion of the rock is usually a stratified sandstone, and affords good building rock, which will be referred to again in its próper place.

Beneath this conglomerate occur shaly and soft rocks from twenty to fifty feet thick, resting on the Carboniferous Limestone. It is very surprising that there should be here only this insignificant amount of strata between the limestone and the conglomerate. This is the place of the sub-conglomerate coals, which in Tennessee, and many parts of Alabama, are of the first importance. Twenty miles east, along the face of the Raccoon, (or Blount Mountain, as it is there called,) and the Chandler Mountain, this stratum is from 500 to 800 feet thick. It there carries four seams of coal. Three of them perhaps unimportant; but the upper one, where cut, measured three feet eight inches thick. And yet in so short a distance, this stratum is reduced to an average of about thirty feet. As might be expected, this thin stratum holds no known workable seam of coal. At only one place, where the Blackburn Fork of the Little Warrior cuts through this rim, was any coal found in it. That was in an irregular stratum of slate, with a still more irregular seam of coal never exceeding three inches thick.

These lower Coal Measures are always characterized by irregularity in their thickness, and in the thickness of their coal seams. A short distance may, therefore, make a great difference in both, yet it is not probable that they will be found of much value on this side of the valley. Above the lower conglomerate, the higher, or intra-conglomerate, or super-conglomerate Coal Measures are found, increasing in thickness toward the synclinal axis, and corresponding with the same measures on the south-east side of the valley, which have been described in a previous report.

It may, however, be here repeated, that the 2,000 feet of coal strata, assumed to have been swept away on the north-

west side of the valley, have been protected and preserved on the south-east side. This was occasioned by the vertical break on that side, whereby the adjacent coal measures did not partake, to any great degree, in the uplift of the valley.* The valley rocks were, therefore, relatively *pushed up past the Coal Measures* to a height of much more than the *whole thickness* of the measures; though subsequently denuded down *below* the *level* of *their surface*. On the north-west side a similar break did not occur, but the fold slanted away into a regular synclinal, exposing its surface to denudation.

On the eastern side of T. 12, R. 1, east, and in T. 11, R. 2, east, there is an elevated region in which the various branches of Dry Creek have their source, that is known by the name of Berry Mountain. This elevation is only a portion of Coal Measure strata, that withstood the denudation. It contains at least *three seams* of coal, which are wanting in the surrounding region. They are of workable thickness, one of them nearly three feet, and are regarded as good shop coals. This is as far as they have been tested. As a report on these coals has already been published, (Report on the Coal Measures of the Plateau Region,) it is not deemed necessary here to enter on a further description.

The face of the Coal Measures presents the same general appearance up to the head of the valley. At the head, and near the middle of the curve, the great fault described below cuts the Coal Measures, as it has done the underlying rocks, and a sink apparently of 200 feet occurs. It may be much more, but 200 feet is all that could be verified. This is, as heretofore shown, a sinking down or throw of the strata, along the south-east side of the fault line. The Coal Measures are therefore thicker on that side than the other. The top of the mountain is the same height on both sides of

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*This seems to be a natural consequence of the peculiar structure, explained below, by which the Blount Mountain synclinal is thrust or lapped *under* the Murphree's Valley Arch. The usual structure in this part of the state is the thrusting or lapping over of the arch towards the north-west, while here, by the underthrust mentioned, the fold or arch *appears* to be thrust up over towards the south-east. E. A. S.

the fault; no appearance of it exists on the upper surface. The north-west side has therefore been denuded more than the other, as much more as the whole depth of the fault.

The thickness of the Coal Measures on the south-east side of the valley cannot be accurately ascertained, as the exact geological position of the rocks appearing in Straight Mountain is not yet definitely determined.

2. *Sub-Carboniferous.*

a. Mountain Limestone, Bangor Limestone.—Immediately beneath the Coal Measures lies the Sub-Carboniferous or Mountain Limestone. Its thickness seems to vary from place to place. This may be due in part to its more or less perfect exposure. From measurements of it, made at various places, it was found to be between 200 and 300 feet. At the very head of the valley just west of the fault line, it shows 200 feet. It is prominent all along the north-western side of the valley; in some places reaching up to near the top of the mountain, in others seen only at the base. Sometimes totally hid by talus from the overlying Coal Measures. Sometimes it shows the effects of cross faults, or flexures in the strata. Where these occur it may be completely sunk beneath the surface for a space, half a mile or more, then rise up to or above its normal level. In some places it was observed that these downward curves were associated with upward curves on each side. The most prominent of these flexures is in section 3, T. 13, R. 1, East. At this place, the limestone sinks beneath the level of the valley, while at, or about a quarter of a mile on each side, it rises up over 300 feet above it. The eye is often deceived by a curvature in the face of the mountain, which gives the appearance of downward cuive, where the formation is only denuded farther back. Careful examination, however, showed that the curvature here was not only apparent, but *actual*, and that it amounted to a flexure or down-bending from the highest points of the limestone, on each side, of over 200 feet. It was also observed that there was a visible flexure in the overlying Coal Measures; and that the same flexure extended

across the valley in a south-east direction, and produced a like depression in every one of the exposed formations. This flexing up and down of the strata, in a direction transverse to the normal dip, has been seen at many places, but generally is more clearly shown in the older rocks.

From this point—S. 3, T. 13, R. 1, east—the limestone continues prominent down the valley to the Blackburn Fork; it again sinks, and apparently a fault crosses the valley opposite this place; the older rocks, however, give the best evidence of it. After rising again to the surface, and being occasionally considerably above it, it sinks beneath the base of the valley opposite Village Springs.

On the south east side of the valley the Sub-Carboniferous limestone can only be seen at two points. The first is a short distance outside of the valley, in sections 26 and 35, T. 14, R. 1, west, where a fault, probably the minor fault below described, leaves the valley and runs southward into Spradling's Cove. This limestone is prominently brought up by it, immediately outside of the vertical wall of the valley, and from thence on to the middle of Spradling's Cove in section 11, T. 15, R. 1, west. The other point is in sec. 27, T. 13, R. 1, east, where a stream has cut a deep chasm through the vertical wall; the top of this limestone is exposed, in the bed of the stream, a short distance inside the base of the vertical wall.

The Carboniferous limestone, so largely exposed on the north-western side of this valley, is the most valuable of our lime formations. It is generally purer than the older uncrystalized lime rocks. It is therefore preferred for the manufacture of lime, and for flux in the manufacture of iron. The principal supply for the use of the furnaces at Birmingham and the adjacent region, is at present obtained from this formation at Blount Springs and at Trussville, and also from quarrics a few miles west of Village Springs, where it exists in great abundance, and of excellent quality. But many other exposures of it, believed to be equal to those in quantity and quality, are presented in this valley. In quality it varies much from place to place—all lime rocks do so—and

it is rarely of the same quality from bottom to top at any place. Usually the members near the base of a lime formation are the best, yet to this rule there are many exceptions. Much of this formation is profusely mixed with matter of Coralline origin. This contains too much silica; and is therefore unfit for making lime, or for flux. Those coralline portions are usually in the upper half of the formation. Sometimes they are wholly wanting, and the entire ledge is good limestone. In general, these coral formations are not scattered promiscuously through the rocks, but lie mainly in horizontal belts; often beginning at a line, or terminating at a line, with pure limestone below or above. Many of the organic remains in this rock are of indistinguishable form, probably sponge-like or gelatinous bodies, whose substance has been replaced by silica. Many, however, are beautiful and well defined corals; among them were formed *chain coral*, *Lithostrotion Canadenes*, *Lithostrotion basaltiforme*, *Cyathophyllum*, *&c.* Great numbers of *Encrinites* and some characteristic mollusks, *Productus*, *Spirifers and Terebratula* being prominent.

b. Oxmoor Sandstone (*Lagrange Sandstone*).—The next formation below* the Carboniferous limestone is known, in this State at least, by the name of the Lagrange or Oxmoor Sandstone. It consists of a heavy ledge of sand rock, from 80 to 100 feet thick. It is prominent all along the Sand Valley, forming generally a ridge of soft sandstone, sometimes rising into bold mural bluffs the whole thickness of the rock. It is also very prominent at many places on the south-east side, sometimes forming prominent ridges, though nowhere presenting mural faces and bluffs, as it does on the north-west side. The rock is properly a freestone, easily crumbled into sand. The great quantity of it that has dis-

*The Oxmoor Sandstone is one of the members of the Mountain Limestone group, and in many places has the limestone both *above* and *below* it. The Mountain Limestone, as a group, appears to be the equivalent of the Chester group of the Western geologists. E. A. S.

integrated has formed immense beds of sand, and (on the north-west side of the Main valley,) covered the little valley at its base with sandy soil. No fossils were found in this rock. It seems to have been so rapidly formed as to preclude marine life; and yet the types of life, so abundant in the rocks beneath it, again present themselves in the limestone above it, as though there had been no break in their existence. This is the more remarkable, because this plate of rock is of great extent, being apparent in all the valleys of North and North-East Alabama.

c. Fort Payne Chert (*Siliceous group*).—Beneath the Oxmoor or Lagrange sandstone, in Murphree's Valley, is a thick bed of cherty rocks of Sub-Carboniferous age, to which we have given the above name.*

These are, by estimate, usually about 200 feet thick, and terminate at the Black Shale.

These siliceous rocks of the Subcarboniferous are well exposed on the north-west side, and generally can be easily traced on the south-east side. They are usually so full of fossil forms and fragments as to be readily identified wherever seen. At two places on the south-east side of the valley were found large deposits of limestone lying at the base of this formation. This limestone is not common in Alabama, except in the Tennessee Valley, though it has been seen at

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*This group, which as a whole, seems to correspond with the St. Louis, Keokuk and Burlington beds of the Western geologists, is made up in Alabama of limestones of varying degrees of purity. When the limestone is highly siliceous, as is usually the case in this state, the calcareous matter has been thoroughly washed out, in exposed outcrops, and the siliceous matter remains mostly in fragments full of cavities, caused by the dissolving out of the stems of encrinites and of other fossils. In the valley of the Tennessee it is usually not diffiult to distinguish between the St. Louis division and those underlying it; but in the anticlinal valleys further south, where this part of the Subcarboniferous formation is represented, as a rule, by loose cherty fragments, the distinction is not so clear, and we have, therefore, been accustomed to use one term to designate the whole siliceous series below the Oxmoor sandstone, and we call it Fort Payne Chert.

E. A. S.

several places in the other anticlinal valleys. It exists in abundance in many regions, and particularly in the regions of the Mississippi river, where it has been most closely studied. It is known as the *Keokuck Limestone.*

The irregularity in the exposures above mentioned made it impossible to define the extent of these calcareous deposits, but they are evidently local. One of them in sec. 27, T. 13, R. 1, east, was estimated to be at least 80 feet thick. It is bedded on the Black Shale. This limestone is generally of excellent quality, much of it crystalline. It is apparently the best body of limestone seen anywhere in the valley, and will doubtless be utilized in the future.

The other deposit of this rock is in sect. 24, T. 14, R. 1, west. Its apparent thickness about the same, say 80 feet. Its base could not be seen, but as it was overlain by about the same amount of siliceous strata as the other, it was inferred that it had also the same base. The quality of the rock, however, is generally different; some of it is good, but most of it has too much silica and other impurities to be of economic value. A large cave opening down into the heart of this limestone, into the lower chambers of which a small stream sinks and disappears, is a noticeable feature.

DEVONIAN.

The Black Shale.—This is a thin but very persistent member, which marks the boundary line between the rocks of the Carboniferous era and those of the Silurian. Its average thickness is about ten feet, in some places less, and occasionally twenty, thirty or forty feet. It is highly bituminous, indicating an organic origin, and its included fossils are wholly marine. It is doubtless of Devonian age, and seems to have been deposited about the middle of the Devonian period. It probably belongs to the bituminous shales of the Marcellus period, or the overlying shales of the Hamilton period, as suggested by Prof. Tuomey.

SILURIAN.

1. *The Clinton or Red Mountain.*—This, with its varied strata and included iron beds, will be hereafter described in detail. It is generally regarded as the lower member of the Niagara period, and is the only representative of the upper Silurian in this region. Its average thickness in Murphree's Valley may be given at about 150 feet.

2. *Trenton and Chazy, Pelham.*—The *Trenton* is conspicuous and easily identified, wholly composed of limestone, over 250 feet in vertical thickness. At its base is a regular stratum, 20 to 50 feet thick, of light colored compact magnesian limestones. These lie conformably on the stratified quartzose rocks, of which the next thousand feet are mainly composed. Near the top of this great quartzose or chert member there is a peculiar conglomerate, and two thin limestone beds; they are by some geologists considered as representing the *Chazy* formation. The fossils however, of which there are many, have been considered by paleontologists as belonging to an earlier age. A very characteristic form of this horizon is *Maclurea magna.*

3. *Knox Dolomite.*—This is in many respects the most important of the older geological formations. It is over 1,000 feet in thickness, and forms the surface over the greater part of the anticlinal valleys of the state. Some of the most important of the beds of limonite or brown iron ore lie upon it. In its lithological characters this formation in Alabama is identical with the Knox Dolomite of Tennessee, as described by Dr. Safford. In its lower part it consists of limestones and dolomites of blue and gray colors, often especially in the lowermost beds, interstratified with shale. The disintegration of these beds gives rise to the fertile red lands which form the best farming areas of this and the other valleys. It is difficult to draw a sharp line of distinction between this lower part of the Knox Dolomite and the upper beds of the underlying Cambrian.

The upper part of the Knox Dolomite consists of gray

dolomites and limestones, all more or less charged with cherty matter, which occurs sometimes in great concretionary masses, sometimes approaching sandstone. The residual soils from the disintegration of these upper beds of the Dolomite, are usually of gray to yellowish color, and the surface is generally covered with angular fragments of the chert. Where the chert predominates, it often forms the ridges of gray flinty gravel which are so characteristic of this formation. The chert usually exhibits concretionary structure, and has small rhombohedral cavities interspersed through it, the empty moulds of crystals of dolomite which once filled them. This peculiarity was first pointed out by Dr. Safford, and seems to be fairly characteristic of the chert of this formation, though we have occasionally noticed it also in the Fort Payne chert. Other details will be given below in connection with the account of the brown iron ore deposits of this valley.

CAMBRIAN.

Coosa Shale, Sparry Limestone.*—The next member beneath the chert, or Knox Dolomite chert, as it is sometimes

*In the classification and description of the Cambrian rocks of Alabama, we are confronted with many difficulties. Dr. Safford has described the rocks of this period occurring in East Tennessee under the names Knox Shale, Knox Sandstone and Chilhowee, to which may perhaps be added his Ocoee group. In the eastern part of our Coosa Valley region we find the precise lithological equivalents of all these Tennessee divisions, and in the Report of this Survey for 1875, which relates to that section, we have identified and described the three types of Dr. Safford—the Knox Shale, the Knox Sandstone and the Chilhowee (Potsdam). Later, when we came to study the Cambrian of the valley regions along the Coosa river and westward, we found these divisionsno longer applicable, for the sandy shales and their bedded sandstones, representing the East Tennessee, Knox Shale and Knox Sandstone, are replaced here by their bedded limestones with clay seams. So also we here find none of the great sandstone and conglomerate masses, which Safford named Chilhowee or Potsdam.

In many places east of the Coosa river these thin bedded limestones, to which we gave the name of Coosa Shales, *appear* to pass below the variegated siliceous shales of the East Tennessee type, to which we had given the name Montevallo or Choccolocco Shales.

We were therefore led to assign the Coosa shale to the base of this division; yet in Murphree's Valley and its south-western prolongation, we find sim-

called, is the *Sparry Limestone.* This member is wholly composed of limestone, with occasional thin beds of soft shale. The limestone is generally blue, and crossed with seams of Calcite or lime spar in all directions. It is a rock that has been noted and studied in many parts of North America. In the Canadian Survey it is called the "Lévis Limestone;" by others the "Sparry Lime rock." Safford, in his Geological Survey of Tennessee, grouped it with underlying and overlying members, and called it "Knox Shale. More recently, however, the United States Geological Survey has definitely placed this rock in the scale as Upper Cambrian. And Prof. Walcott, Chief Paleontologist of the Survey, who has given much labor to the study of its fossils, draws the line between the Upper Cambrian and the Ordovician or Silurian, at the top of this rock, or rather *between this rock* and the clearly defined Silurian strata above, thus

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ilar thin-bedded limestones with clay seams or bands *immediately below* strata of undoubted Knox Dolomite age. These shaly limestones underly usually level tracts of badly drained lands, to which the name "Flatwoods" has been given.

In consideration of the facts above named we were led, in the Preface to the Plateau Report, published in 1891, to the conclusion that the lithological variations in the Cambrian strata of Alabama were due, in the main, to geographic position; that while sandstones and sandy calcareous shales were accumulating along the eastern border of the Coosa Valley area, limestones, and alternations of limestone with clay beds, were accumulating further westward, presumably more distant from the coast line of that period; and that the "Flatwoods" limestones, with their inter-bedded clay seams, are the time equivalents, not only of the Coosa Shales, but also of the Choccolocco or Montevallo Shales and their included sandstones.

To sum up, the Cambrian of Alabama consists of thin-bedded limestones often with clay partings (our Coosa Shale or Flatwoods rock), passing downward into siliceous limestones and calcareous shales, which, towards the east, graduate into calcareous sandstones, alternating with calcareous shales (Choccolocco or Montevallo Shales), and enclosing, near the base of the series, great beds of sandstone, often conglomerate. The type of these sandstone masses is the Weisner Sandstone of Cherokee county, which is, I think, undoubtedly the equivalent of Dr. Safford's Chilhowee. These sandstone masses and the beds of calcareous sandstone near the base of the Cambrian seem to be confined to the eastern border of the Coosa Valley, while further westward in Wills', Murphree's, Opossum and Jones' Valleys the limestones with clay seams or partings are the only Cambrian rocks exposed. E. A. S.

including this rock, and possibly some strata above it, in the Upper Cambrian. It is one of the most prominent formations exposed in this valley. In descending the valley it is first brought to the surface in Sec. 5, T. 13, R. 2, east. A few miles farther down, 1,200 feet of it is exposed. This deep exposure extends down to the Blackburn Fork of the Little Warrior. Below this it is less prominent; and it passes entirely beneath the surface in Sec. 12, T. 14, R. 1, west. It is barely seen at any point from here, to a little below Turkey Creek in Jefferson county. This rock is prominent in many parts of Jones' Valley, in the Cahaba Valley, and especially so in the upper Coosa Valley. It is occasionally brought to the surface in Will's Valley, but not in the Sequatchee fold, at least below the Tennessee river.

The amount of denudation that has taken place in the deepest parts of this valley is thus shown by these measurements and estimates of thickness of strata to have been about 5,300 feet, or a little more than one mile in vertical depth.

STRUCTURE.

It is, however, to the geological structure and mineral resources of this valley that the attention of the reader is specially directed, both on account of the peculiarities of the former and the importance of the latter.

The Great Anticlinal Fold.

Murphree's Valley, like the other Silurian valleys of North-east Alabama, is a valley of elevation; that is, a valley eroded out of the crest of an upward fold of the strata. It is not within the scope of this report to examine or enquire into the causes or processes of such folds, or such valley-making erosions. Upon these there might well be much difference of opinion among geologists, and the unprofessional reader would not be benefitted by mere speculation.

But as to the fact that these valleys have been thus produced, there is no controversy. Every one of them presents in its structure the most conclusive evidence of its truth that science can demand.

The most inattentive observer must have noticed that in these valleys the inclining rocks, the stub ends of their strata, are all dipping at some angle with the horizon, and in some definite direction towards one or both sides of the valley. And that if this dip of strata were extended outward and upward, it would describe or produce a fold overarching the valley; and possessing the form and volume which the fold would have had, if it had not been eroded. Thus the structure and contour of all folds, however much eroded, can be represented and studied, and ideally reproduced.

These upward folds of strata present in their different forms all degrees of flexure, from the incipient or symmetrical fold, with its strata dipping equally on each side from a common anticlinal axis to a completely doubled, or folded axis, lapped over to one side, with its strata all dipping one way, and hence called "monoclinal."

It has been shown in the Appendix to Squire's Report on the Cahaba Coal Field, that the valley separating the Cahaba and the Warrior Coal Fields is, in the vicinity of Birmingham, a double one, Jones' Valley proper on the east and Opossum Valley on the west. Both these component valleys exhibit the regular Appalachian type of structure, i. e., they are unsymmetrical anticlinal folds with the steeper side towards the northwest. The axis of the anticlinal is consequently found always near to the northwest edge of each valley, and over the greater part of the area of each the strata have a gentle dip towards the southeast, while the much steeper northwest dips are confined to the extreme northwestern edge of the valley. Very often the fold has been pushed or lapped over towards the northwest, so that the strata on the northwest side of the anticlinal axis stand vertically, or are pushed beyond the vertical so as to be re-reversed. When faulting occurs, as is very generally the

case, the southeastern limb of the fold has been pushed up over the northwestern limb, overriding and hiding from view a greater or less proportion of the strata on that side of the fault.

One who had examined the structure of the valley in the vicinity of Birmingham, would naturally expect to find that its prolongation northeastward into Murphree's Valley would not present any features essentially different; yet in Murphree's Valley we find the strata with gentle northwesterly dips occupying the whole of the valley except its extreme southeastern edge, where they stand either vertical or have been reversed and dip back towards the northwest, the very opposite in all respects to what has been described above as typical for the Appalachian regions.

The structure of Murphree's Valley is shown in figures 1 and 2, which represent sections across the valley, figure 1 near its head, and figure 2 in the central parts.* From the inspection of those figures, it will be understood that to the southeast of the valley lies the synclinal trough of Raccoon or Blount Mountain, with its strata nearly horizontal, but in reality gently sloping towards the northwest from the eastern margin of the mountain down nearly to the vertical wall, which makes the common boundary at once of these measures and of Murphree's Valley. *Straight Mountain*, as this vertical wall is called, is a part of the connecting limb between the synclinal of Raccoon Mountain and the anticlinal of Murphree's Valley. I say a part, for the great fault shown in the figures has cut out a greater or less proportion of the strata of this connecting limb. In the sharp bending back

*In constructing these sections to true scale, it has been found that some of the formations occupy on the surface considerably more space than the thickness of their strata, with the observed dips, would justify. This is particularly the case between the summit of west Red Mountain and the rim of Sand Mountain, where, with the average dip observed at many of the outcropping ledges (fifteen degrees to northwest), a thickness of 1,500 to 2,000 feet of subcarboniferous strata would be required. A liberal estimate of the thickness of these formations, derived from many actual measurements, would be 1,000 feet. We have thus been forced to the assumption that the dips of some of the beds below the surface is considerably less than that shown at the outcrop. E. A. S.

FIG I. SECTION ACROSS MURPHREE'S VALLEY.
NEAR UPPER END

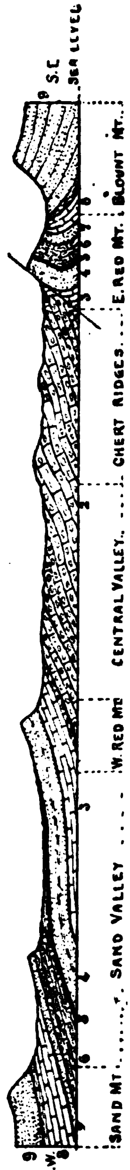
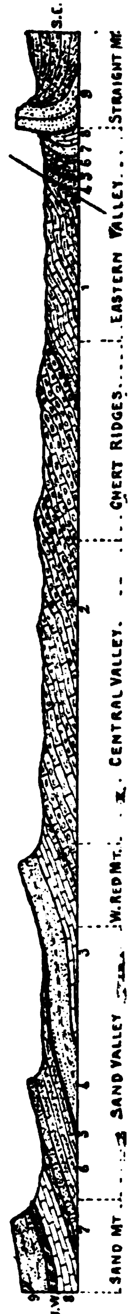


FIG. II SECTION ACROSS MURPHREE'S VALLEY
NEAR CHEPULTEPEC.



CARBONIFEROUS { 9 COAL MEASURES
8 BANGOR OR MOUNTAIN LIMESTONE
7 OXMOOR OR LAGRANGE SANDSTONE
6 FORT PAYNE CHERT OR SILICIOUS

DEVONIAN. 5 BLACK SHALE

SCALE
VERTICAL AND HORIZONTAL THE SAME.
ONE MILE

SILURIAN { 4 CLINTON OR RED MOUNTAIN
3 TRENTON OR PELHAM
2 KNOX DOLOMITE

CAMBRIAN. 1 COOSA SHALE

E.A.S. DEL.

of the strata of this vertical or reversed limb, it was inevitable that there should have been a certain amount of shearing and displacement of the beds, and we should be prepared to find here evidence of minor faults, and of the squeezing out of certain beds in this upturned and broken part. In figure 1 it will be observed that the vertical wall does not exist, its place is occupied even by a depression, and there is very probably more or less of displacement and faulting between the reversed beds to the west of the depression and the gently dipping coal measures to the east of it. The strata in this depression are so covered by the broken fragments of the rocks which border it, as to make their examination almost impossible.

On the valley side of this vertical wall (fig. 2) a space of about one-fourth mile is occupied by formations 4, 5, 6, 7—all dipping at high angles to the northwest—all very irregularly exposed, and all *reversed or inverted*, the newer dipping and passing beneath the older. These formations are here very closely crowded together, often lapped over each other, often some of them completely hidden. In the aggregate they occupy only one-eighth of the space they fill on the other side of the valley.

On the northwest side of these inverted members, and closely abutting on some one of them, is the Cambrian limestone. A great fault exists here, but its position is recognized only by the abnormal junction of diverse formations. The dip of strata near the fault varies from 40 to 60 degrees to northwest, and gradually diminishes to about 15 degrees at the foot of Sand Mountain. Two miles beyond that, the northwestern dip terminates in the synclinal trough of the Warrior river. It is thus seen that from the fault at the southeast edge of the Cambrian limestone, to the northwest side of the valley and beyond, the fold is perfectly regular, and presents the appearance of one side of a symmetrical fold. This regular side embraces about seven-eighths of the entire floor space of the valley. It is in the remaining one-eighth lying between this fault and the southeast edge of the valley, that all the geological difficulties are found.

It is evident that there is not space enough on the southeast side of the fault to contain the counterpart of the strata on its northwestern side, in any form of fold that could be assumed. That large portions of the strata on the southeast side of the fault have gone down in it—been engulfed or folded under—is evident.

Their absence and the direct contact of the Cambrian strata on the one side with Clinton or Subcarboniferous on the other, indicate the position of the great fault. This fault extends the whole length of the valley but is not throughout of equal magnitude of displacement. Its greatest depth is in that part of the valley where the Cambrian limestone is exposed, above that towards the head of the valley it gradually diminishes in depth.

It is very generally believed that the structural features of the Appalachian region have been produced through the agency of a force acting from the direction of the Atlantic ocean, i. e. from the east and southeast, by which the strata have been compressed into much less space than they occupied in their original horizontal position. This lessening of the area was accomplished by folds and flexures and by the rupturing of the sharply bent strata and the sliding of one portion bodily over another portion. An examination of this region will show that in nine cases out of ten, the folds when not symmetrical, have been lapped over in the direction towards which the force was exerted, and where faulting occurred, the overriding portions were pushed or thrust up in the same direction, i. e. northwest. In Murphree's Valley all this is reversed, and we find the strata occupying such positions as they would normally have assumed under the action of a compressing force acting from the northwest, raising a fold, lapping it over towards the southeast, and after faulting thrusting the northwestern half of the broken fold in the same direction.

Inasmuch as we have no evidence of any compressing force acting from this direction, we must explain the peculiar structure of Murphee's Valley under the dynamic conditions which obtain in other parts of the state. This

structure can be explained under the supposition of a compressing force acting from the southeast, by assuming that the trough of the synclinal lying to the east of Murphree's Valley was lapped under the anticlinal of the valley, and when faulting occurred, the underlapped beds were *thrust under* those to the northwest of the fault plane. Thus while the arch of the fold of Murphree's Valley appears to have been thrust over towards the southeast, as if by a force coming from the northwest, in reality, the motion of the strata has been in the opposite direction, impelled by a force acting as in the other cases from the southeast, those beds whose lateral motion was greatest being thrust under those which yielded less in that direction, thus uplifting them into an arch with its steeper side, its fault and its reversed or overturned strata towards the south-east.

Transverse Folds.

In addition to the plicating effects of lateral pressure already considered, there has also been in this region a general, though less prominent, transverse folding of the strata. A flexing, faulting and wrinkling of all the formations at, or nearly at, right angles with the axis of the valley, or approximately in a south-east and north-west direction. Whether this system of flexures has resulted from pressure or other cause, whether the cause operated from the south-west or from the north-east, would be much easier asked than definitely answered. That it does exist as a widely extended system, slightly affecting the geological structure, and very distinctly modifying the topography, is a matter of daily observation.

These transverse flexures are more distinctly seen in the ridges and high lands, where their outlines are freely exposed. In some places they extend for miles, in others they can be

traced only a short distance. Some are mere swells or depressions, others constitute faults varying from a few feet to several hundred in depth. Every high point is found to be on one of these upward flexures; and generally every stream that cuts through the ridges, and every wind gap is on one of the downward flexures. They have doubtless greatly affected the drainage and erosion of the country, by offering ready-made outlets and passages for the waters.

In the mining operations on Red Mountain, these flexures and faults are found to be very numerous. In stripping down to bed rock, every few rods, or less, exposed one of these upward curves, even where the surface gave no indication of its existence. They are found to occur with considerable regularity, and generally show displacement of but a few feet. Yet they are so numerous that in the aggregate they plicate and shorten the country's diameter in a north-east and south-west direction, approximating that produced by lateral pressure from the south-east. The compression of the latter force was mainly accumulated in the valleys, while that of the former is diffused all over the country. The faces of all the ridges and mountain brows present the undulations and flexures of the strata. They present the appearance of successive earth waves, having undulated the earth's crust and left their form impressed upon its structure.

But in addition to those long undulatory waves, and the short and numerous choppy waves which have left their form and impress on the earth, there are others found far apart that have heaved up extensive tracts of country and depressed others, thus affecting drainage and topography. These might be termed earth tidal waves. They do not generally give steep or high elevations—they do not make conspicuous land-marks, yet they control the drainage of large areas of country, and have determined the flow and volume of the streams. Only brief mention will be made of these, as few of them are wholly within the area embraced in this report. The area of the coves north-east of Jones' Valley is one of these swells, from whence flows one of the head streams of the Cahaba to the south, some streams to

the west and north-west to the Warrior, and the main head of Canoe Creek, which flows east and north-east to the Coosa. In that depressed basin, where streams flow in from every point of the compass, it unites with the Coosa, whose whole course has been in the opposite direction.

This great swell whose highest points are in this cove region, extends east and south-east to the Coosa river, making a very well marked watershed, and west and north-west as far at least as the Warrior river. But a still more prominent and important swell, with the same south-east and north-west trend and extending more than half the breadth of the state, makes the great watershed between the Tennessee, and the Warrior and Sipsey rivers. From the eastern side of Blount county to near the western boundary of the state, a distance of more than a hundred miles, not a single stream crosses this divide. Even where the great Sequatchie fold was cut through it, near its south-eastern end, it still makes a very distinct watershed. Many other regions of elevation of less prominence, but with the same trend and apparently the result of the same cause, might be given, and many others which show the modifying power of both *lateral* and *transverse* pressure. But these are deemed sufficient to fix the reader's attention on this class of phenomena, and impress the fact that this force has been one of the main factors in complicating the structure,and shaping the topography of this region of country.

OTHER PECULIARITIES OF STRUCTURE.

Absence of certain formations on the south-east side of the valley.—Before proceeding to details, it may be well to notice some features peculiar to the south-east side and upper end of this valley. One of these is the entire absence of the Trenton limestone on that side of the valley.

A short distance below Village Springs is the last exposure of these rocks at the foot of East Red Mountain. From that point to the head of the valley, they are not exposed on that side. Opposite Village Springs, the lower Siluran chert and

Clinton come together at the foot of East Red Mountain; the Chert dipping steeply to the north-west, the Clinton steeply to the south-east. A fault here has engulfed the Trenton formation. Half a mile east of this point the Clinton is found near the top of the mountain, standing nearly vertical and trending nearly east and west; while a little to the south of it the Lagrange Sandstone makes the very top of the mountain, with a moderate south-east dip. One mile or less north from this latter point the Lagrange Sandstone is found at the edge of the valley in a massive vertical ledge, with lower Silurian Chert (Dolomite) lapped up on its north-west side. These things show that the uplift has been very irregular in this region; that it is traversed by faults running in different directions, which have broken the continuity of uplift and the sequence of strata. Their presence is always indicated by one or other of these results, and to their effects all such seeming anomalies of structure must be attributed.

Another feature that has already been referred to is the almost entire absence of the Carboniferous or mountain limestone on the south-east side of this valley. At only two points, in low gaps, have any of it been seen, while the underlying Lagrange Sandstone is generally very prominent.

Comparison of the ends of the valley with the central part. Near the upper end of the valley its south-east edge is Coal Measures, dipping steeply to the south-east. A narrow gorge separates this rim from a high ridge of Sub Carboniferous chert dipping 60° to 80° to the north-west. In its diverse dips and displacements this part resembles the Village Springs section, only newer formations are on top.

That there was less pressure on the reversed portion of the fold here, or at least less yielding to this pressure, than in the middle portion of the valley, is evident from the fact that the reversed strata were here left standing at a much higher angle than there. It will be understood that to *completely reverse* strata their fractured ends have to be forced through an arc of 180°. These partially reversed strata have described an arc of 100° to 120°, lacking 60° to 80° of com-

plete reversal; while in the central portion of the valley they have described an arc of 135° to 150°, lacking only 30° to 45° of complete reversal. It is therefore reasonably concluded, that with less yielding to the lateral pressure and with less displacement in this portion of the fold, the absence of the vertical wall for a few miles may be considered as explained.

The Horse Shoe Curve of the upper end of Red Mountain is a striking and peculiar feature. It circles around the upper end of Red Mountain Valley, making a cove of its upper part, without materially diminishing its width. In its outer circle it closely approximates the curve of the end of the valley.

This peculiar topographical structure resulted from the effects of two distinct causes. 1st. A flexure in the main fault at the upper end of Red Mountain Valley—it there suddenly deflects from an east north-east to a north northwest course in passing through Red Mountain; but beyond that, again resumes its former course. Hence, the denuding waters were not aided by this fault in the excavation of this sub-valley above the deflexion of the fault to the west. Hard strata were encountered, and the further abrasion of this sub-valley to the north-east was arrested.

2d. Because the waters above and beyond this point found outlets along each side of the valley. These waters with their interlocking heads eroded the Red Mountain and its curved upper ends, and its adjoining Chert ridges on the outside, and were the main agencies in carving out its present form. But for the obstruction occasioned by the flexure in the fault at this place, it is more than probable that the denuding waters would have flowed down it, and eroded out the Red Mountain Valley to the head of the fold. The ends of Red Mountain and the Chert ridge would then have been left trending in the direction of the axis of fold, instead of being united together.

The end of the fold.—The head of the valley is the end of the fold to the north-east. All around its terminal rim the

dip of the strata is away from the axis of uplift. The fold ended where the valley ends. In the broad table lands beyond it there is no evidence of rupture or uplift. No ridge or fold or fault is visible;* there is no sign of disturbance save a gentle dip to the north west, in this long and broad expanse of table land, which extends from the end of this valley to the Tennessee river.

ECONOMIC GEOLOGY.

Having thus given a general outline description of the valley, showing its structure and the present arrangement of the various formations exposed, a detailed description of its minerals and materials of economic value will be better understood. Of these, iron ore is the most prominent. It exists in two forms, the *Red Hematite* of the Clinton formation and the Brown ore or *Limonite*, found at several horizons, from the top of the Cambrian to the base of the Coal Measures. They must be presented separately, and the Clinton demands the first place because of its greater importance.

HEMATITES OF THE RED MOUNTAIN OR CLINTON FORMATION.

The Clinton is the great iron bearing formation of Alabama and other states. It lies here comformably on top of the Trenton limestone, and is capped with the Black Shale. Its aggregate thickness varies from place to place, but generally approximates 150 feet. The upper twenty feet, however, contain no valuable seams of iron ore. A vertical section will show the average structure.

*The fault spoken of elsewhere as cutting through the rim at or near the head of the valley, cannot be followed very far beyond the rim of the valley.
E. A. S.

General Section of the Clinton Strata.

	Black Shale.		
	Shaly and slaty beds, clay and some iron ore		15 feet.
	Heavy bedded sandstone, sometimes 40 to 50 feet, usually		10 "
No. 1.	Iron bed, ore lenticular or concretionary	2 to	4 "
	Yellow sand rock, soft, gnarly, no cleavage		10 "
No. 2.	Fossiliferous iron ore bed	6 inches to	2½ "
	Soft, dark, irony sand rock	7 feet to	15 "
No. 3.	Iron ore bed, varying greatly in quality	2 "	7 "
	Flaggy sandstone, shale and clay	20 "	40 "
No. 4.	Iron ore, hard, rough, pebbly or lenticular	2 "	20 "
	Dark grey sand rock, often massive	20 "	50 "
No. 5.	Iron ore, soft, fine grained, dark ore, often limy	3 "	20 "
	Trenton Limestone.		

In addition to the five beds of iron ore presented in the section, there are often several others; but as they are not very persistent, and were found nowhere thick enough to be of value, or even of good quality, no notice has been taken of them.

This section only approximates the general structure and arrangement. To present it by accurate measurements from place to place, would require a very great number of sections. These, by their variances, would rather confuse than aid the reader. An average portion of the formation was therefore taken and measured, by which all other portions can be compared.

The variations in the Clinton are great and numerous; they embrace all its constituent members. The rocks vary in thickness and quality, in color and texture. The iron ore beds vary in number, and in quantity and quality of the ore; and these variations take place rapidly. No one mile of this formation is the exact equivalent, or counterpart of any other mile. This formation was by the older geologists well named "The Protean Group," because of its want of uniformity and the rapidity of the changes in its strata.

The Clinton is very prominently exposed in this valley. It constitutes the cap, or top member of the *Red Mountain*, the whole length of the valley, and it occurs in more or less broken sections, also on the south-east side. The *Red Mountain* standing as it does towards the north-western side of the valley, with its strata dipping north-west, gives generally on its south-east face an exposure of the whole thickness of the Clinton formation. From this face it dips at an angle of 18° to 20° down the north-west side of the mountain and beneath Sand Valley.

DETAILS OF OCCURRENCE OF RED ORES.

North-western Side of the Valley.

To give a consecutive description of this formation, we begin near the head or upper end of the valley, at the end of the eastern curve of Red Mountain. At G. B. Wade's, in the north-west quarter of S. 1, T. 11, R. 4, east, about 200 yards south of his house, and close to the Walker Gap branch of Bristow's creek, the Black Shale was seen, dipping north-west 75° or 80°; about 50 feet west of it a bed of yellowish clay, and other strata indicating the Clinton formation. Three-fourths of a mile north of Wade's, in the south-west quarter of S. 36, T. 10, R. 4, east, at Mr. Boyd's, are several small openings in two seams of red ore, the cuts sufficient only to expose the tops of the seams. The eastern one sandy, dark ore, resembling the *lower bed;* the western one better ore—no fossils seen. The dip of the ore as seen in the cuts is nearly vertical, say 85° north-west.

One hundred yards or so, north of these cuts, the same seams of ore were seen in the road—trending *west* of north—and nearly vertical, and apparently dipping downward beneath a ridge of Sub-Carboniferous Chert—which begins at this point and lies to the north east. This ridge rises to a height of 200 feet and is composed wholly of Sub-Carboniferous Chert with its characteristic fossils. The Black Shale was not seen in the ridge; but its position is very clearly indicated by its usual accompanying rocks. These rocks stand mostly vertical, some dipping perceptibly east by south, others west by north.

East of the apparent place of the Black Shale, the manganiferous belt which lies above it, could be plainly traced, and the trend of the Clinton strata where last seen would place this formation in the foot of this ridge, to the west. This arrangement was now clearly seen in the north-west quarter of S. 25, T. 10, R. 4, east, at the apex or inner point of the curve of Red Mountain. Here the Clinton plainly shows on the *inside* (Valley Side) of the Chert Ridge, (Sub Carboniferous,) and extends over one-third of the distance up it from the base. In the extreme point of the curve, and at the line of the fault, a point of Clinton strata with the uppermost ore bed exposed and in vertical position, marks the top of the divide. There is a *bend here in the fault line;* it cuts the Red Mountain in a direction nearly north and south. Its line shows a deep depression which has been eroded by a stream that rises at this point and flows north. On the east side the Sub Carboniferous Chert rises 200 feet high above this point, and on the west, the Clinton Strata at about the same height cap the Red Mountain, with a dip of 30° north-west. The existence of this gap was not suspected before as it cannot be seen from any of the roads. It was further observed that the Chert Ridge here is over 200 feet above the base of the eastern rim of the valley—but the Sub-Carboniferous (Oxmoor) sandstone was not exposed anywhere on this side. The dip of strata of the Coal Measures of the eastern rim, is 60° to the east at this point, and for two miles further down, the dip gradually changing to S. E. and lessening in degree further down the valley—to increase again to verticality still lower down.

South-westward from the fault line Red Mountain is mainly composed of Clinton strata; with Lower Siliceous Chert overlying and covering its N. Western Side, and occasionally a little of the Trenton showing at its S. Eastern base. But few exposures of iron ore had been made by digging; one was in S. 25, T. 10, R. 4 E., on bed No. 3 General Section. This bed has usually a rock or clay parting at or near the middle, three or four inches thick. In this place it was rock, and the

cut had only been driven in far enough to show decomposed ore above the parting, and 18 inches of hard dark steel grey ore beneath it. It was inferred from the usual arrangement of this seam, that it carried here three feet of ore. This ore is limy and crystallized, but low in Silica—hence a valuable ore of iron, as it not only furnishes its own flux, but carries probably enough lime besides to flux an equal weight of soft ore. It can be very economically smelted in connection with certain other ores. This bed is of this quality in many places as will be hereafter shown.

Another opening on the same bed was found S. W. ¼ of N. W. ¼ of S. 35, same T., ore about the same quality, but not quite so thick. This was on the lands of J. H. Vanzandt. This opening like the former one had only exposed one half of the bed, and was not cut far enough in to show the full thickness of the seam, or a fair sample of its ore.

Outcroppings of iron were seen here, above, and below this bed, probably from beds 1 or 2, and 4, of the General Section, Owing to the smoothness of the face of the mountain the edges of the Clinton strata are not exposed—they are covered over deeply with earthy matter, making the positions of the iron ore beds hard to locate. The general absence of roofing rocks has caused decomposition of the ores near the surface. Enough surface specimens were seen, to warrant belief that the beds are all here, but the rocks are generally soft and shaly, and few of them come to the surface.

In S. 34, T. 10, R. 4, E., a large outcrop of iron limestone was seen--it carries very little iron, and no indication of a bed of ore was found in connection with it. It lies near the S. E. base of the mountain, almost at the level of the valley. It is evidently near the horizon of bed No. 5 of the General Section.

In the adjoining Section 33, higher up the mountain, several pits had been dug many years ago for iron ore, and beds 1, 2 and 3 of the General Section had been found. The excavations had not been made deep enough to reach good ore, or even to find the thickness of the beds. It was

only by examining adjacent surface specimens that the beds dug for could be identified.

The Red Mountain here is a broad flat topped ridge, with Clinton strata from below its eastern base to about two-thirds of the way down its western side, where Black Shale had been exposed.

Where the Sand Valley road crosses the mountain near Noah Nelson's, the Black Shale is higher up, near the top of the mountain. South of this point in a well sunk in the edge of the valley, (S. E. side of Red Mountain) a seam of iron ore was found.

The massive heavy bedded sand rock that usually caps the first or upper ore bed was not seen N. E. of the Warrior River. It is probably wanting in that part of the mountain. Its absence in part accounts for the smoothness of the mountain, and the great disintegration of the ore beds. From S. 33, T. 10, R. 4, E., to the Warrior River in S. 14, T. 11, R. 3, E., a distance of four miles, no openings were found on the ore beds, nor any out-cropping of ore. The Black Shale shows occasionally in place, near the top of the mountain, or on its north-western side, and the Clinton strata extend down into the valley on the south-east side. The Trenton rocks are not exposed—they are not even uncovered in the bed of the river. The whole of the mountain here is of Clinton strata—which are not largely composed of hard rocks. The iron bearing stratum is therefore thick. It hence seems probable that ore beds of corresponding thickness may exist here; yet nothing unseen can be certainly predicated of the protean strata of the Clinton.

Immediately on the southwestern side of the river, the Red Mountain becomes much higher. The Trenton is brought up by a rapid transverse flexure. In a little over a half mile, it has risen over 300 feet. Its lower stratum, the yellowish magnesian lime rock, is seen over fifty feet above the level of the river. For a short distance the Red Mountain is abnormally high. This flexure is short, only about a mile in length. In the town of Walnut Grove, one mile from the river, the top of the Trenton rocks shows in the

streets, dipping at a small angle to the northwest. And opposite this place, where the Blountsville road crosses the mountain in S. 22, the top of the Red Mountain is sunk down in a gap, only about 40 feet high. This gap shows only Lower Siliceous rocks—the Clinton being sunk beneath the level of the valley. In the space of a little over a mile, the flexure has been up, and then down again, each, more than the whole thickness of the Trenton strata. Nearly opposite this high part of the mountain, in S. 15, on its N. W. side, in the Lower Siliceous formation, is the first important out crop of manganese. It continues to show for several miles along that side of the mountain. The manganese will be described in its proper place; but it may be here remarked that in that section of the mountain that carries manganese, there seems to be less iron ore, and of quality generally inferior to the average; that there could be any relation between the iron, and manganese, seems very improbable, and this fact is here merely noted. Several openings have been made into the iron ore, in the next three miles S. W. of Walnut Grove. Only the top bed, or No. 1, was found, and the samples obtained were inferior.

A very heavy bedded massive sandrock, begins now to occupy the lower portion of the Clinton. It was first seen a few miles below Walnut Grove, and gradually increases in thickness. It takes the place of the dark yellowish gnarly rock, near the base of the General Section. This rock continues, about to the west line, of T. 12, R. 2 East. In all this space ore beds Nos. 4 and 5, were not seen, and are not believed to exist, certainly not in sufficient quantity to be of value. All the ore that has been seen in this space therefore belongs to one of the three upper beds.

In Sects. 1 and 2 of Tp. 12, R. 2 East, was the first place found below Walnut Grove, that gave indications of good ore. Several openings had been made on bed No. 1. The ore is wholly concretionary, of rather low grade, but uniform in character. At all the openings in these sections, the thickness of the bed varied, from 2 feet, to 3 feet, averaging about 30 inches. Bed No. 2 was not found here, and the

position of No. 3 did not seem to have been known to the prospectors. Its outcropping was found here, and pointed out. This bed usually shows very little out-crop but its position may always be closely approximated if bed No. 1 is found. It lies by the usual slant of the mountain, about 50 feet lower down. The color of the ground at its edge, will also help to determine its exact position.

Without knowing the thickness of bed No. 3, and the quality of ore it carries here, it would be premature to decide finally on the value of this, as an ore region. It may be here the best bed, as it was found to be farther down the mountain. In Section 11, same Township, similar openings had been made with about the same results, but here also the third bed had been overlooked. In Section 15 of the same Township, the upper bed had been opened; ore of the usual quality, and thickness say 3 feet, and assaying from 35 to 40 per cent. iron. This is about the average grade of bed No. 1 as seen for several miles above here. The third bed had been slightly opened here, but not enough to fully show either its thickness, or quality. It seemed to be thicker than the upper bed, and the ore promised to be better. It carries soft, fine grained, red colored ore. This bed is often limy and hard, but at no place from Section 1 to Section 21 in this Township was it found of that character. None of the openings on this bed in this space were deep enough to furnish samples, from which the quality of the ore could be safely determined, nor even to show the full thickness of the bed. This was judged to be about 4 feet thick, and to carry the best ore that this part of the mountain affords.

The upper part of the mountain here is shaly and has suffered much denudation; several gaps are cut through it, down to the Trenton rocks, and the edges of the Clinton strata beyond are covered with debris so as not to be readily found. It is certain however that two beds of ore exist here, of fair quality, and good thickness. Half a mile to the S. W., near Hoods X Roads in S. 15, several openings were examined. Bed No. 3 had been cut, in a pit sunk in a field,

and again filled up, it was said to be 4 feet thick, very soft ore. It was not roofed in with rock here, and probably the ore was much decomposed.

In the N. E ¼ of S. 16, same Tp., several openings had been made in the upper bed, it did not come up to the average here, either in thickness or quality. The mountain here is heavily capped with Lower Siliceous, cherty strata, and the heavy sand rock that caps the upper iron ore bed, is very thick. It seems to be the case, that where this cap rock is unusually thick, the underlying iron ore beds are thin. No reason is apparent why this should be so—it is a co-incidence, however, that has been noticed at many places. In the remaining portion of S. 16 that lies N. E. of the Calvert fork of the Little Warrior, persistent efforts have been made to expose all the beds of iron ore. If any one of them is not fully shown up it is No. 3. The upper bed is nearly three feet thick, composed wholly of concretionary hard ore, of light brown color, and very much resembling spathic iron ore, or clay iron stone. It is of very low grade, about 30 per cent. of iron. No. 2 was not found; it is not believed to exist here—nor has it been seen for several miles above this place. Six feet below the normal place of the 2nd bed, is a thin bed of purple colored ore, one foot thick. It is not only peculiarly colored, but it also carries fossils of *Cyathophyllum*, and allied corals, and is speckled, and streaked, with crystals of carbonate of lime. This bed has not been seen at any other place. Of course it is not thick enough to be of value, even if the ore were good; and is only interesting because it is rare and very peculiar. A small bed about the same size as this, is sometimes found between the 1st and 2nd beds. But it is not persistent, only occasionally intercalated. This one probably only runs a short distance—intercalated between the 2nd and 3rd; or the 3rd bed may have become divided at this place, this being the upper member, though the former opinion is most probable. The distance between it and the 3rd bed is too great, we think, to justify the latter opinion.

An opening was also made on the 3rd bed; it carries clean

as the bed generally carries, but considerably better than in section 16.

In the N. W. ¼ of the S. W. of Sect. 20, same Tp., another opening had been made on the third bed, now almost at the top of the mountain. The soft ore bench had been replaced with hard limy ore, the same as the lower bench. The bed showed a face of four feet, with a parting of yellow shale and irony clay 17 inches thick in the middle—solid ore 31 inches. Ore dark steel gray, limy and crystalline. From analysis of similar ores, it is judged to run from 15 to 25 per cent. of metallic iron. This ore could not be profitably smelted alone, but mixed with soft ore, for which it would furnish the necessary flux, would be economical to the extent of the cost of the flux at least.

About 200 yards west of the last opening, and beyond the top of the mountain on the same tract of land, an opening was made on the second bed. This showed a face of 30 inches of solid, good, fossiliferous ore. This is an unusual thickness for this bed; it rarely exceeds two feet, and is generally less. This bed usually carries the best ore, generally assaying about 50 per cent. of metallic iron, and holding less than one-third of one per cent. of phosphorus. At this place the average of the bed was judged to carry 48 per cent. of iron. The practiced eye can judge very closely of the amount of metallic iron a specimen contains, but the phosphorous cannot be seen. It is *always present* in iron and its ores, but the *amount* of it can only be determined by chemical analysis.

At this place the Trenton limestone is pushed up very high in its upward curve, and the upper part of the Clinton is denuded back, and therefore crops out on the N. W. slope of the mountain. A short distance to the S. W. these members assume their normal position, and the whole thickness of the Clinton, at least to the first iron bed, is exposed on the S. E. side.

In the S. W. of the S. W. of Sect. 20, same Tp., some partial openings had been made on beds 1, 2 and 3. Each of

them showed ore of good quality, but they had not been dug deep enough to show the thickness of either of them. A good show of ore could be made here with little labor. Fifty feet by slant surface measure, extended (as is usual) from the top of No. 1 to the base of No. 3, thus including three ore beds in a vertical depth of twenty feet. Should these beds be here of usual thickness, they would aggregate over nine feet of ore. Hence nearly half of this portion of the Clinton is iron ore.

Two hundred yards west of these openings another and larger one was made on the third bed. This exposed a face of ore 4 feet 8 inches. This ore is of good quality, soft fine grained, color dark gray. It is very remarkable indeed that the ore beds, especially this one, should change in volume and quality so much and so rapidly. In less than a quarter of a mile we have seen it increase one-half in thickness, and change from dark shaly ore to hard limy ore; then in another quarter of a mile increase twenty-five inches in thickness, become free from lime, soft, pulverulent, and of good quality throughout. Changes in this bed are not usually so rapid or so great, yet it is the most variable bed of this formation, and has never yet been found exactly the same for any great distance.

On the E. ½ of N. E. ¼ of S. 30 T. 12 R. 2 E. is a very fine exposure of bed No. 1. A partial opening had been made on it, but evidently not at the thickest place, or on the best part of the bed. The opening however showed about four feet of ore. Fifteen feet slant surface measure reached from the top of this bed to the out-crop of No. 2. Both beds are therefore comprised in seven feet vertical. The second bed was only 12 inches thick, but the ore excellent, would assay about 50 per cent, the top bed 42 to 45 per cent. Both beds could be very advantageously mined together, as there is only a soft shaly parting of two feet between them. It was very evident that a little farther along the mountain to the N. E. the out-crop showed the bed to be heavier than where it was opened and samples of ore were seen there of higher grade than any seen in the openings.

Near the middle of this section (30) several small cuttings had been made on these beds. No. 1 showed 30 inches of ore. partly concretionary of a deep rich red color, partly lenticular, and partly rough or coarse grained ore; it was estimated at 45 per ct. of iron. No. 2 showed good ore as usual. No. 3 had been opened only enough to show the upper bench, which was 30 inches thick, ore soft dark grey. This bed is usually, if not invariably in this region, in two benches, of about equal thickness. From the exposure made, this bed was judged at this place, to carry 60 inches of ore.

No other openings were found on this bed for several miles farther down the mountain. Its position and importance are not generally known. It very seldom shows much on the surface, and therefore requires close observation to determine its position, if that be not already known. The existence of this bed was not known, till the writer pointed out its position, and made openings on it, a few years ago.

And yet in many places it is the most important bed in the Red Mountain. For the last two miles we have seen it to be the heaviest, and most of that distance carrying 40 to 45 per cent ore. Below this place for several miles, only the 1st and 2nd beds have been opened.

In the S. W. ¼ of S. 30, T. 12, R. 2 E., numerous little pits had been dug on the upper bed, or No. 1; all showed a good degree of uniformity in thickness and quality. Measurements were made of each. They ranged from 30 to 36 inches of ore, and in quality will approximate 40 per cent. of iron. It is, and has been for miles above here, almost wholly concretionary ore. Perhaps this term may require explanation. It is a form of ore that is not common elsewhere, and is only possessed by this bed in its course through Township 12 of Range 2 East. This ore has been called *concretionary*, because it is formed in masses of various sizes, each apparently around a *centre or core*. These masses are built up of *concentric coats* around this central core. These masses are of irregular shape, owing to the manner of compacting in the bed; and a large mass will generally contain several smaller ones inclosed in its con-

centric layers. The ore is generally of fine grain, and clear red color. The only defect apparent in this ore is a small lump of fine earthy, or aluminous matter, that generally forms the core of each concretion. These, however, are not considered of sufficient volume to interfere with the successful reduction of the ore. This form of ore is sometimes known by the name of "pot ore" among miners, and is generally regarded as a high grade ore, and easy of reduction.

In S. 36, T. 12, R. 1 E., the ore changes rapidly, and becomes sandy and coarse, and is therefore of little value. Near the centre of this section is the highest point of Red Mountain. The top of the mountain is here by Aneroid measurement 450 feet above the valley, and by the railroad survey, the valley opposite to it is 850 feet above the Gulf. The top of this point is therefore 1,300 feet above Sea level. One hundred and fifty feet of its upper part are Lower Siliceous Strata. A short space below the Black Shale comes an immense thickness of the sand rock that caps the upper iron ore bed. This rock is usually about ten feet thick, here it is fifty. At only one other place, in S. 16, T. 13 of R. 1 E, does this rock show such abnormal thickness. But the most abnormal thing noticed here, was the smallness of the iron ore beds. A good natural exposure of the bare rocky face of the mountain on the S. E. side, gave the outcrop of the ore beds, as follows:

Bed No. 1.—8 inches.		The 3 upper beds aggregate 1 foot of ore.
" 2—2 "		
" 3—3 "		
Bed No. 4—00 "		Wholly wanting.
" 5—00 "		

These measurements were taken beneath the highest part of the mountain. No seams of clay, or soft shale, exist between the little iron ore beds, or elsewhere on its naked face—nothing but hard rock. The iron ore beds were comparatively close together, and were only identified by their succession. Farther down the mountain, ore bed No. 1 was easily traced, it gradually thickened from the middle of the mountain, towards the S. W. side, where it measured 30

inches. The quality of this ore is generally very poor; a few inches at the top of the bed is better than the balance. but even this is very low grade.

At the S. W. foot of this high point, there is a peculiar feature. The strata are flexed downwards so much that the Clinton is beneath the level of the valley. It has disappeared, and immediately behind its place the Lower Siliceous rocks alone make the mountain, which thus continues unbroken. It presents the appearance of a great sink in the mountain, though probably a cross fault exists here. None of the edges of the strata being exposed, so as to show displacement, it cannot be positively stated that this is the fact. But several irregularities near here, and along a North and South line crossing here, show unusual disturbance. About one-fourth of a mile south of this sink is a ridge trending southwards, in part composed of Clinton strata, with Trenton rocks intervening between it and Red Mountain. A little over a quarter of a mile north by west from this place, on the western foot of the mountain, there is a lone peak of Coal Measure rocks, nearly 100 feet high, with Carboniferous lime rock at its base. It stands alone nearly a quarter of a mile from Sand Mountain, with the narrow Sand Valley between. About one mile from this sink, north, is a ridge rising 250 feet above Sand Valley, and trending across it in an E. and W. direction. It rises up steep and narrow, its top only 20 to 30 feet broad. It is mainly composed of broken up Lagrange Sandstone, with Lower Siliceous shales at its base, but its strata do not appear to have the usual dip. So far as could be seen its strata are horizontal, or incline a little to the N. E. This was mainly shown by a thin stratum of red chalk iron ore, almost at its top. This stratum, about six inches thick at the western end, increases to nearly two feet at the eastern. It runs nearly horizontal in that direction, but showed a slight dip to the northeast. This stratum of iron ore was often seen and traced in the Sand Valley, among the upper members of the Lagrange (Oxmoor) sandstone. This sharp ridge had evidently been forced up at least 250 feet above its

normal position—and coincides in no respect, either with the axis, or general uplift of the valley. Almost opposite the western end of this ridge a gap exists in the Sand Mountain, and nearly due South from that is the sink in the Red Mountain, and across the valley still South is Clowdus' Gap in the Straight Mountain. It the reforeseems probable that all these abnormal features here may have resulted from a fault running North and South, with diverse displacements.

This sink in Red Mountain is in S. 1, T. 13, R. 1 E., half a mile West of Oneonta. Very little iron ore comes to the surface in this section. It is generally buried too deep under the Siliceous chert to be seen, or perhaps ever to be made available. In Section 2 adjoining on the west, good out crops of the top bed are seen all along the face of the mountain. Cuts were made in this bed at two places, in this section, and the ore found of nearly average quality, 31 inches thick at one and 36 at the other. Near the middle of Section 2 there are two gaps in the Clinton close together; between them, a point much denuded, showed the strata very plainly. The top bed, or No. 1 of the general section, is three feet thick, No. 2, 10 to 12 inches. No. 3 shows plainly, but was not opened. No. 4 carries soft, dark grey ore, and iron limestone, alternately. It was only very slightly opened, and sectional measurements could not be made. The whole thickness was estimated at ten feet, of which two feet of good, soft ore were exposed. The iron limestone is of good quality, and carries more than the usual per cent of iron. The 5th bed does not exist at this place. The indications however show that it begins a very short distance below this point, and continues for several miles down the mountain. In the remainder of Section 2 no openings had been made, but beds 1 and 2 crop out all along near the top of the mountain.

In Sect. 10, same Tp., several pits were sunk in the ore beds, and gave the following measurements:

Bed No. 1. Four feet one inch, with a two inch clay parting in the middle, about average quality. Intercalated bed, one foot, reddish hard ore.

Bed No. 2. Fossiliferous ore, one foot excellent ore.

Bed No. 3. Face 7 feet, ore dark steel grey, in two benches with a three inch rock parting; also an irony clay parting near the middle of the upper bench, believed to be only the decomposed ore, which would soon become solid. Most of this ore is soft, with occasional blocks hard in the centre, indicating the presence of some lime in the bed, which would rather enhance than diminish its value. This bed is thicker here and more promising than at any other point yet seen on Red Mountain.

Bed No. 4 was here only opened enough to show its existence. It appeared to carry soft dark colored ore, in connection with iron limestone, as seen in section two, but is probably not so thick as estimated there. An opening had been made to reach bed No. 5, but only displaced samples of its ore had been reached. These were found scattered in the clay in pieces of 5 to 15 pounds weight. No other samples of ore were mixed with them. They differed greatly from the ore of any of the overlying beds, and closely resembled in color and texture the ore of the fifth bed. No doubt is therefore entertained of the existence of this bed at this place. And the relation of the underlying Trenton to the exposed cap rock of the bed, would indicate it to be thick. This is the first clear evidence of the existence of this bed that has been shown below the Locust Fork of the Warrior. And it was seen at only one place above that. It is not believed to exist between Sect. 2, T. 13, R. 1, and S. 14, T. 11, R. 3, East. But from Sect. 2 to S. 30, T. 13, R. 1, E., evidence of its existence has been seen at many places.

The ore of this bed may be distinguished from other ores by its fine grain, soft texture and dark color. Its position is at the base of the Clinton, and it is therefore deeply covered by the debris from above. There are therefore few natural exposures of this bed, and hence it is less known than any other. Its presence, however, may be generally known by a bench occurring just above the Trenton. This bench has been formed by the wearing away of soft material. If the

hard rocks of the Clinton are bedded directly on the Trenton limestone, no such bench has been formed. But if a large bed of soft iron ore and its associated soft shales exist there, they were readily eroded away back from the edge of the Trenton, and this erosion would generally be in proportion to the thickness or softness of this stratum. The debris, or talus from above being spread over this bench, has buried the edge of the abraded bed many feet deep, and it hence makes no out-crop. Even the great exposure of this bed near Village Springs (hereafter to be described), was not a natural exposure; but the result of cutting a drainage ditch on the side of the public road. The water soon cut down into the soft iron ore and exposed a sight which thirty years ago was covered up by several feet of earthy matter. This bench at the lower edge of the Clinton is generally broad and well marked from the middle of section two to the corner of section 16, in this Township, and several points farther down. It again becomes prominent a mile above Village Springs, and continues to Village Creek.

Near the middle of S. 10, T. 13, R. 1, E., the Trenton limestone is flexed downwards beneath the level of the valley. The flexure is short; it regains its normal height again in half a mile. Mill Creek cuts the remaining strata of the mountain at this downward curve. This flexure crosses the valley, as has been already noticed in the description of the Carboniferous Limestone. It therefore opens a way of easy access to the coal fields on either side, and through all the sub-valleys, and makes this place peculiarly well adapted for the manufacture of iron. All the needed raw material could be concentrated here, more economically, than at any other point in the valley.

Through the remaining portion of this section the upper bed of iron ore crops out boldly, and occasionally the 2d and 3d beds are seen. This is also the case in N. W. ¼ of sect. 15. The surface indications show that ore is abundant, and that probably all of the beds exist here.

In section 16 several openings have been made on the upper bed. It is more exposed and easier found than any

other, and has therefore received the most attention. At the several openings it measured usually three feet; some places an inch or two, more or less. It shows here a more uniform thickness, and is less variable than farther up the mountain. In grade it is two to five per cent. lower than in sections 10 and 15. It gradually lowers in grade through the remainder of section 16 and S E. of 17, and N. E. of 20. The 2d bed also diminishes in thickness; at several places it was found only two inches thick. The 3d bed was partially opened at one place in S. 16, only two feet of shaly red ore was found. Either this bed was very much diminished, or the location was not a favorable one to show it. Below this place it has not been seen, and no digging has been done to find it.

The main supply of ores for several miles is now found in the lower beds. In the N. E. ¼ of S. 17 the 4th bed begins to show prominently on the surface. It here is two feet thick, solid, hard, coarse ore, heavily weighted with sand. Below this, and throughout Sect. 20 it is evidently thicker, probably three feet. Its out-crop is covered by debris from above. Almost innumerable slides have carried large sections of the bed down below its normal position. These have followed each other down to the limestone; sometimes to the foot of the mountain. Each one has carried huge blocks and masses of this bed along with it, and thrown them heaped and piled along the face of the mountain. These blocks are of all sizes, from a few pounds to more than ten tons. One block was measured which contained 220 solid feet of ore. These blocks are nearly as hard, and as little affected by exposure, as the sand rocks of the mountain. From the east line of Sect. 20 to the west line of the Township, there is a greater show of iron ore on the surface than anywhere else on Red Mountain. But it is sandy, low in iron and high in Silica. It is confidently believed that the 5th bed exists here, and that it carries iron ore of a better quality. Some specimens were found on the face of the mountain that seemed only referable to the 5th bed. But its position is so heavily covered by the slides from the 4th bed, and other

debris, that it would require a great deal of labor to expose it.

In Section 30, same Township, the hardness of the ore from the 4th bed and the size of the displaced masses of it seem rather to increase. Careful search on the most-abraded points was here made for the other beds. No. 3 was found, and as far as could be judged by the surface, is from 3 to 4 feet thick; ore rather too shaly near the surface, may carry good ore farther in. No. 2 was not found. No. 1 is thinner than heretofore seen, and inferior.

The Blackburn Fork of the Little Warrior cuts through the Red Mountain near the middle of this section. On the face of the mountain, on the South side of the river, the displaced blocks of hard sandy ore from the 4th bed are encountered. There is so much of it that it seems improbable it should all have come from one bed, only 3 feet thick. But it has. At the top of the mountain it is washed naked, and in place, and measured just 3 feet. A little farther along, the abrasion of a powerful current is very plainly seen. It had cut down the mountain below this bed, and carried the huge blocks of ore far down on the N. W. side. For a wide space the whole of the Clinton had been swept away. How strange that that little stream, now flowing 300 feet below, should ever have flowed here! Yet it had, though then the mountain was not so high. If it had been, the course of the stream would have been changed. It would have flowed down the valley to a different outlet. Plain proof here, were any needed of the gradual rise, and gradual denudation, of these barriers. Their uplift, and abrasion, went on together, and the course of the stream was unchanged. How long since the last uplift, we may never know, but it was evidently at no remote period of Geologic time. The principal falls in all the streams which enter, or leave the valley, *are yet at the margins; at its very edge.* These must recede farther, and farther up the streams, under their constant corrasion, until the fall in each is equalized. Bars of hard rock are slowly cut by running water—but these falls are all in Carboniferous rocks, which are readily abraded. It is therefore evident that the period since the elevatory

movement ceased, (if it has yet ceased,) cannot have been a very long one, or these falls would have been farther up the streams.

In Section 31, same Township, the 4th bed continues to be the most prominent. It still carries hard ore, but has less silica than near to, and beyond the river. It is evidently improving in quality, but has not diminished in thickness. The top bed which, for some distance back, had been abraded from the top of the mountain, and its out-crop buried by the debris on the other side, is again seen on the top of the mountain. Its thickness is less, and its quality inferior to what it is toward the North-east corner of the Township. About the same as it was seen in Section 16. Though it is probable, that at and near the out-crop here, for want of roofing in with hard rock, a fair sample of the bed has not yet been reached. Only a small portion of this section is on the Red Mountain, and the Clinton enters the next Township near the North-east corner of Section 1 of Township 14.

In T. 14 of R. 1 W., the Clinton presents much variation, and will have to be described in detail. In S. 1 the 4th bed is still the most prominent. In some places great masses of it have slid far down the mountain, and are thickly strewn along its South-eastern base. The ore is softer than we have seen it in Township 13, but yet carries too much Silica. It is estimated to contain 30 to 35 per cent. of iron. The 3rd bed was not seen here. And the 1st and 2nd were of little importance. In this Section the iron limestone, which has been found occasionally, as a thin member, in the Township above, now begins to thicken, and become prominent. In Section 11 it occupies a large space. Its thickness where seen to the best advantage, was about 50 feet. It all carries some iron, but it is unequally distributed. Some portions of the edge have much more iron than others, in some parts it is streaked with hard carbonate of iron and sand. All of it here has much sand, which will probably render it unfit for furnace use. It would make a very pretty building rock, but its hardness and grittiness would make it very difficult to dress, and it would not be durable. The iron and lime of

this rock both dissolve freely, and wherever it comes to the surface the face of the mountain and the bottom lands below are of a deep red color. Any one can tell from this, as far as it can be seen, where this iron lime rock is exposed in the mountain. It is continuous from here to Village Creek.

Careful search was made for iron ore beds in this section but none were found. In Section 14 a thin bed of ore was observed about 1 foot thick. It was believed to represent bed No. 1.

In the next Section (15) the bulk of the iron lime rock is greatly increased. It forms the bold, steep, bluffy face of the mountain. Where it is the most massive, it was too steep to be measured. Its thickness was estimated to be over 100 feet. At its base it was conformably bedded on the Trenton Limestone, and its naked top frequently makes the summit of the mountain; thus seeming to have absorbed the whole of the Clinton. If any Clinton strata lie above it at such places, they will only be found far down the western side of the mountain. None of the upper beds were seen in this section, and the material of the 4th bed is probably scattered through this immense iron bearing rock. Indeed it would seem that all the material of the Clinton formation had here been compounded together. The irregular distribution of these materials, especially noticeable in the iron streaks, gave it the appearance of having been deposited in agitated swirling waters. This hypothesis is not positively asserted, but the want of conformity in the arrangement of its streaks, the inharmonious arrangement of materials, and the semi-concentric rings everywhere seen in its structure, strongly suggest this opinion. At least this description will convey a tolerably clear idea of its structure in this section, and the one above.

In Section 22, same Tp., the volume of the iron lime rock has sensibly diminished. It no longer reaches up to the top of the mountain. From fifty to one hundred feet of Clinton strata are occasionally found above it. In one of these points or knobs capping this rock was found an excellent out-crop of the ore of bed No. 1. It was a matter of much surprise to

find it carrying first-class ore at its first visible out-crop. The bed had not been opened; its thickness seemed probably two feet. This is in the N. W. ¼ of Sect. 22.

The trend of the mountain here embraces the eastern and S. Eastern portions of Sect. 21. Beds No. 1 and 2 became prominent. At one place where they were seen to the best advantage, the second bed was based upon the iron limestone. A thin parting separated it from the first bed. Both were practically one bed. They measured four feet face at the out-crop. Two large areas of the upper bed had been washed bare; the overlying strata all removed and vast quantities of the ore were thus exposed on the top of the mountain. Farther from the edge these beds evidently thickened. The dip to the N. W. was less than 12°. The beds therefore descend the mountain on its N. W. side near the surface. It was seen at the surface in Sand Valley, half a mile to the N. W.* A vast area of available ore exists here. It will mainly have to be got out by stripping off the loose surface. It is not capped by solid rock, and the surface stripping will be less expensive than mining, while the quantity of ore that can then be raised per hand will be vastly greater. This is probably the largest body of available red hematite ore that exists in this county.

These beds of ore, Nos. 1 and 2, were traced and closely examined from the Eastern side of Sect. 21 to Village Creek, in the Southern part of Sect. 28. It may be here remarked, however, that in Sect. 28 they dip to the S. W. as well as to the N. W., and here descend rapidly far beneath the top of the mountain. At the South line of S. 28, they are about 150 feet below the top of the mountain. This, probably, arises largely from the thinning down of the iron limestone in that direction.

This great bed of ore is here above the average of the bed in quality. Will average from 40 to 50 per cent. of iron.

*This has, since the above was written, been found to result from a great slide on the N. W. face of the mountain at that place, which carried some of the ore bed and underlying iron lime rock down into Sand Valley. They are not there in their normal position. The dip also increases to 20, and even 30 on the face of the mountain.

It is of medium solidity, or hardness; hence will be easily mined and handled.

The third and fourth beds do not exist here. The space where they belong is yet taken up by the iron limestone. It is probable that the 5th bed begins about here, or a little higher up, but as the S. East side of the mountain now has more slope, its position is wholly obscured by talus. It is not seen till near the centre of Sect. 28.

THE GREAT IRON ORE BED NEAR VILLAGE SPRINGS.

In Sect. 28, T. 14, R. 1, W., the Red Mountain has been cut in two by a fault. Through the gap thus made a public road has run, since the country was settled. On the upper side of this road, and near the base of the mountain, is exposed probably the largest mass of red hematite ore that exists in the State. It is the 5th bed—the one lowest down in the Clinton. It is based directly on the Trenton limestone, which is here seen slightly cropping out in the wash at its base. Originally no iron ore was seen here; the talus from the mountain, and detritus from the gap beyond, had covered it over. Gradually, the wearing down of the public road exposed some iron bearing shales near the top of the bed. These were long considered of no prospective value. To carry off the surface water, a channel was cut on the side of the road. The water soon cut down to the ore, and made a deep channel through the bed. To this its discovery was due. The ore is generally soft, fine grained and dark colored. In shade it runs from a deep brown to dark grey and black. In texture and quality it is not uniform. Near the top and near the middle is a thick belt of rich, coarse graiued ore. Beneath each of these are still broader belts of nearly black ore, fine grained and of inferior quality. The dip of the different parts of the bed is neither regular nor uniform. The dip in different parts varies from 10° to 28°. Generally near the base of the bed the ore was of lowest grade. The different parts as seen will vary from 35 to 50 per cent. of iron.

The exact thickness of this bed could not be calculated

from the dip and exposure. Its slant surface measures 83 feet from top to bottom, and assuming the average dip to be near 20° would make its thickness over 30 feet. This was the nearest approximation that could be made from the present data. But it is probable that a slide has occurred here, that the upper part of the bed at least has doubled on the lower part. If this has not taken place, the difference in dip in different parts of the bed, and the apparent duplication of certain stratà of ore, must be left wholly without explanation.

This is a most valuable bed of ore, not only from its great bulk, but it carries some ore of superior grade to any heretofore found in this bed. Then its position near the base of the mountasn makes it so accessible as to add greatly to its value. Its position here is a little below its normal place, probably caused by the fault referred to. Half a mile or more farther down the mountain it was seen at a somewhat higher level. There has been a slight downward flexure near the main exposure of the bed, but the amount of it is not great. This bed probably extends for a mile or more up the valley. The shape of the slope or bench above the top of the Trenton almost gives assurance of its extension that far. As has been heretofore observed, a bench in the Clinton, immediately above the Trenton, may be regarded as indicating the presence of this bed. Should this observation be fully verified, large and extensive bodies of ore will yet be found which are not thought of now, and the value of the Clinton formation will be much increased.

Opposite Village Springs, in the Southern part of Sect. 28, Village Creek cuts through the Red Mountain. The two ore beds, 1st and 5th, were seen cropping out at the end next the creek. Neither of them seemed to carry as much or as good ore as farther up the mountain. But their relative positions are of much Geological interest. They are now the *only beds in the Clinton.* The *top* and the *bottom* ones of the series. For the others there is now no place. They, and their associated strata, have either disappeared, or been absorbed in the body of the iron limestone. Will they re-ap-

pear and resume their former relations? This question cannot be fully answered here; they may do so farther down the valley, but in the bounds assigned to this report, they appear no more.

The iron limestone was seen below Village Creek, though it was inferred, from its thickness above the Creek, and its gradual taper, that it probably extends about a mile farther. Below the Creek the rocks are but little exposed, and the geological structure cannot be seen. This is to be regretted, for the manner in which the *upper* and *lower* iron ore beds *come together*, if indeed they do so, would be of very great interest to a geologist. From their relative position where last seen, they must either *come together at the end of the iron limestone*, or other strata must occupy *its* place.

COMPTON MINES.

Since these pages were written extensive mining has been, and is still done, at this place, by J. W. Worthington & Co.; both of iron ore in Red Mountain—and of Lime Rock quarried from the foot of Sand Mountain on the opposite side of Sand Valley. These extensive works are known by the name of COMPTON MINES. They are connected with the Mineral R. R. at the Village Springs by a branch road three miles long, crossing Village Creek, and passing through the gap it cuts in Red Mountain, into Sand Valley. Thence one branch of it runs up the foot of Red Mountain to the iron ore mines; the other crosses Sand Valley to the Lime Rock quarries.

As was foreseen the mode of mining iron ore here was by stripping from the top of the mountain donwards, as the most economical and expeditious. This mode was first adopted and the ore bed was laid bare along the top of the mountain for nearly half a mile. Ore was thus very rapidly and cheaply raised, and run down the mountain to the raiload by cable cars. It was soon found however that many faults and flexures from N. W. to S. E. crossed this mountain and véry seriously interrupted the regularity of the ore bed. Also that the dip increased to the N. W. on the face of the mountain, and soon made stripping two deep to be done advantageously. Farther stripping was therefore abandoned,

and for the last two years regular mining, and tunneling has been pursued. Drifts are run along the face of the mountain so to as be self draining—and give a gentle descent to the loaded cars. Only the 1st, or upper bed of ore is worked here, or rather the 1st and 2nd beds combined; for they in fact are here united and practically make one bed, or seam. At the brow of the mountain their united thickness was from 4 to 6 feet. This thickness has gradually diminished with depth and increased pressure—and the lowest levels have now only 2½ feet of ore.

Sixty miners are now employed here, and the daily output is 200 tons of ore.

The quality of the ore is practically the same from the top to the base of Red Mountain—only the seam is gradually diminishing in thickness from increased pressure. And a doubt is now seriously entertained that the iron bearing Clinton does not extend westward beneath Sand Valley. We must await further developments before modifying our views on this subject. On the west side of the town of *Compton*, at the base of Sand Mountain, are seven quarries worked by this company. The quarries are on a great ledge of Carboniferous Limestone, that is here very prominently exposed. About 200 hands are employed, and the daily output is 1,000 tons of lime rock, mainly used for flux by the Birmingham and Bessemer furnaces.

In addition to this, Col. Hatch operates another quarry further to the S. W., and near the line of Blount and Jefferson counties. He employs about 40 hands, and puts out about 200 tons of lime rock per day, which goes to the same markets.

The lime rock that is mainly quarried here is a ledge of solid rock 16 feet thick, of unusually pure carbonate of lime. This ledge yields by analysis from 95 to 98½ *Carbonate of Lime*, and 1.70 to 2.20 of Silica, with only a small fraction of one per cent. of Carb. of Magnesia.

This rock is so perfectly adapted for fluxing and the best that can be obtained for this purpose, that the furnaces require and demand it, to the exclusion of all others. Hence,

much lime rock here that is really good, is thrown away; much of it that would do for flux, or make excellent lime, is wasted and thrown on the dump. The company pays the same price (12½ cents per tram load) for refuse, as for selected shipping rock. This falls very heavy on the profits of the company. Two-thirds, probably three-fourths, of the rock mined here is thrown on the dump as refuse.

The company does all the drilling, for quarrying and pop shots; supplies all the dynamite, or explosives that are needed in this work. The drilling is done by compressed air, delivered by pipes from a central station, where the air is compressed by a large stationary engine.

Compressed air is found to be much more desirable and comfortable in working than steam power; it dispels the dust and diffuses a cooling atmosphere around the drills, enabling the operatives to work in comfort under the exposure of intense sunshine and heat of this Southern climate.

Quarrymen here work by the *car load*, or piece work, not by the day. They work in the morning and in the afternoon, and on an average make about 12 tram car loads per day, netting them as wages about $1.50 on an average.

The face of the bluff in all these quarries is now from 50 to 75 feet. It seems to be no longer practicable to quarry this amount of rock, and only ship 16 feet of it. Arrangements are, therefore, being now made to tunnel and mine out this *pure ledge alone*. An experimental drift is now being run into the bluff at one of the quarries, to test the feasibility of *mining* instead of quarrying this rock. If this project succeeds—if they can successfully mine *this ledge alone*, and put out an amount of rock equal to what is now done by quarrying—it will be a great saving in expense to the company. It will require fewer hands to operate the quarries and attain the same results, or product of the quarries; and while wages of operators will not be diminished, the profits of the company will be increased, and the importance of the quarries very largely augmented.

The town of COMPTON, built up solely by this mining and quarrying industry, is the largest town in Blount county.

It is regularly laid out, about a mile long and a quarter of a mile wide; and though not compactly built up, houses about 250 operatives and some 1,200 inhabitants.

It is a place continually busy with the noise and throb of industry, and daily sends out from 50 to 60 car loads of lime rock and iron ore.

We have now reached the lower end of Murphree's Valley, at its junction with Jones' (Opossum) Valley. A change in the direction, or strike of the Red Mountain takes place here. It now for several miles trends S. S. W. A change also occurs in the structure of its rocks, and their arrangement, and the position of its included iron ores. These changes probably begin above the Jefferson county line, and without a notice of them, this part of the report would not be complete.

The Trenton rocks do not come to the surface for several miles. The Clinton makes the mountain. It is therefore not so high as formerly, and shows Clinton strata alone on the S. E. side. The rocks become thin and rather shaly. The trend of the mountain brings it closer and closer to the great Murphree's Valley fault, and at Turkey creek they co-incide. The Clinton strata are here thrown vertical, and afford the first opportunity to see the structure since crossing Village creek. The effect of this fault has been to break up the Clinton into knobs and short ridges, with diversity of trend. In several of these for two miles N. N. E. of Turkey creek, good shows of iron ore have been exposed, but these were not sufficient to show the whole structure. At Turkey creek, however, on the Eastern side of S. 30, T. 15, R. 1, W., is as fine a natural section of the Clinton as could be desired.

The vertical uplift caused by the fault has here raised the Clinton in a *low vertical, crescent shaped ridge.* The curve is S. E. and South, and is cut by the creek at its most southerly point. A mill has been erected here by J. P. Blackburn, and the mill race was cut entirely through the vertical Clinton strata. All parts of it are therefore exposed, from near the Black Shale (which was not seen) to the top of the Trenton, which now makes its appearance in the creek

above. The Clinton rocks are very uniform in texture, and are all thin or shaly. Toward the base side, where they join the Trenton, they are harder and of a bluish color. In all other parts they are reddish brown. The race had not been cut at right angles with the strike, but quartering and meandering, hence measurements were not made. But the thickness of the strata exposed was estimated to be 200 feet. In this estimate the position of the Black Shale was assumed to be in a deep hole below the mill. But the most important and interesting thing here is the *iron ore*. It all lies in *two beds*, or rather in *one bed*, with a parting of three feet. It is at about one-third the thickness of the Clinton from the top, and therefore occupies about the same position as the third bed in the upper part of the mountain. The upper part of it is *20 feet thick*, the lower part *9 feet thick*, with a rock and shaly parting of three feet between. Whole thickness of the bed *32 feet*, *with 29 feet of ore*. This may have been two beds formed here very close together, but as the ore is the same in each, both in quality and structure, it is thought proper to consider both parts as one bed. This ore is strictly first-class ore. It will average over 50 per cent. of metallic iron. The ore is partly lenticular or flattened grain, and partly round grain, closely compacted together; heavy and solid, but not hard. It is not identical with any of the beds hitherto described in Red Mountain; its ore is different from any of them, though nearly identical with some yet to be described in the S. E. side of the valley. What has become of all of the other Red Mountain beds? Why is it that only *one* mammoth bed exists here in the Clinton formation? Our knowledge of the geological structure is not yet sufficient to explain these apparent anomalies.

The exposures of the Clinton ores on the S. E. side of the valley.—The examination of the Red Hematite ores on the south-east side of this valley next demand attention.

Beginning at the head, or upper end of the valley, we find exposures of this ore in regular order, till we reach Green Wade's in S. 36, T. 12 of R. 3, east. From this point it does not appear again on the surface for fifteen miles

down the valley. It has been eroded away, and the ends of the Clinton formation covered over by Sub-Carboniferous Chert.

In Sec. 27, T. 12, R. 2, East, this formation comes again prominently to the surface, and the following section was obtained here:

Section of Clinton Strata.—S. 27, T. 12, R. 2, E.

Top bed. No. 1, round grained, rough ore.....	4 ft. 0 in.
Rock soft yellow	3 ft. 7 in.
2d Bed. No. 2, Fossiliferous ore......................	0 ft. 3 in.
3d Bed, not seen, rock and clay......................	15 ft. 0 in.
4th Bed, or No. 4, blue colored, soft ore	3 ft. 0 in.
Rock hard..........................	1 ft. 6 in.
5th Bed (No. 5), soft, dark brown ore..............	4 ft. 0 in.
Total Clinton strata................................	31 ft. 4 in.

And carrying 11 feet 3 inches of iron ore. From base of 5th bed to Black Shale was 50 feet only, while between the 4th and 5th bed was a bar of rock 18 inches thick. Below bed No. 5 the rocks were covered up, so that the position of the Clinton to the underlying strata could not be seen. This was probably near the fault line. Only silt and clay covered the surface along the base of the Clinton for some miles. This was the only place, for many miles, that the 5th bed was clearly seen. Nor was it seen, or supposed to exist, in the Red Mountain opposite to this place. But this need not excite surprise; the ore beds are *driven identical* on both sides of the valley, at right angles with the strike.

The Clinton ores on this side of the valley are all contained in the long strip of reversed strata heretofore described, cut off by a deep fault and sunk on the N. W. side. They hence dip to the N. W. at a high angle, usually 30° to 45°. Where these ores show close to the line of the fault, they extend under ground but a short distance, only till the fault is reached. In the adjoining section 34 a good show of ore existed a few years ago. A bed four feet thick stood up on the bank of a little stream. It was just at the fault, the stub end of a bed. During a freshet this was undermined

and swept away. That stub end was all of it. In very many places on this side of the valley, in the low places denudation has cut below and swept away all the beds. In the low grounds, if the beds cannot be seen, the probability is that they do not exist. As a rule, the high grounds only can be calculated on to yield much ore. Even they are sometimes deceptive, as occasionally they may be near the fault. An instance that occurred near this place will show this. A speculator, who was trying to sell again, sunk a pit on a good seam of ore four feet thick. To show that it maintained its thickness and quality, he wished to cut it again at the depth of 25 feet. He continued to dig, and at 14 feet from the surface came to the fault, where the iron stopped. These remarks are thrown in here, because this structure not being generally understood, many have built high hopes on iron prospects, which are visionary, and many have invested money in such property, on which they will never realize.

In the N. E. ¼ of section 33, same township, some small openings had been made, but not sufficiently deep to show the thickness of the beds, or to identify them. No good ore was seen in this section. A thin streak of Clinton strata, but carrying very inferior ore, runs along the S. E. edge of the brown ore in the S. E. ¼ of 33, and the N. W. of S. 4, T. 13, R. 2, E. It is again seen in the S. E. ¼ of Sec. 5, but unimportant both in quantity and quality. The space where it should exist has been deeply eroded by a stream of water, and probably the better portion of it has been swept away.

Through sections 12 and 13 of T. 13, R. 1, E., there is scarcely any sign of ore remaining. On a few higher points, only a little can yet be seen. The Sparry or Cambrian Limestone, which comes to the surface first in Sec. 5, T. 13, R. 2, E., is now a prominent member; and as the S. E. edge of it is on the line of the great fault, the presence or absence of the Clinton can be clearly told. If the next member adjoining this limestone is the Lower Siliceous, or the LaGrange, then it is certain the Clinton has been engulfed in the fault. If the space between these formations and the

limestone is sufficient to contain the Clinton, then we may be assured of its presence, though covered by debris of other formations. In the S. E. ¼ of Sect. 12, this limestone and the Lagrange sandstone come together; the Clinton and Lower Siliceous therefore *have both gone down in the fault.* In a portion of section 13 only a part of the Clinton has disappeared. A little farther S. W., in the same section, the Clinton comes up in a bold ridge, with Lower Siliceous Chert scattered over its surface. Several openings have been made here; ore generally shaly and poor. The top bed measured two feet; ore of fair quality. In these two sections 12 and 13 much labor has been lost in searching and digging for iron ore. Not because it does not exist, but because the labor was not expended in the proper places.

In the S. E. ¼ of S. 13 there is a notable example of the Clinton, after being for a space engulfed in the fault, again coming above the surface near the Chepultepec and Springville road. For a quarter of a mile the Clinton does not show, it is below the surface; then it rapidly rises into a ridge 70 feet high. Near the N. E. end of this ridge, in a pit, its strata were seen dipping N. E. 75°. In a short space farther to the S. W., or down the ridge, it resumed its usual N. W. dip. It was very evident, therefore, that the N. E. end of this ridge had been forced up, almost vertically at the end of the submerged portion. It makes a prominent ridge for over half mile. In the eastern part of section 23, most of the Clinton is again beneath the surface.

In the S. W. ¼ of N. E. ¼ of S. 23 T. 13 R. 1, E; on the lands of J. P. Box, the iron ore beds are again brought to the surface. A bed of hard, solid, rough ore, was here seen two feet thick, lying close to the Black Shale, with no visible intervening rocks. It is certainly the bed classed as No. 1 in the general section. The nonexistence of roofing rocks above it is a local peculiarity. On the same tract at a lower level, a bed of similar ore was seen, of about the same thickness. It is probably the same bed. The rocks were not exposed so as to decide definitely, and relative levels, afford no criterion for identifying ore beds on this side of the valley. The

strata are flexed upwards, and downwards, with very great irregularity. Some other small beds had been cut on this tract, but they were apparently unimportant. Slight indications of manganese were also seen on this tract, and the one south of it, in the same section. A small body of it probably exists here in the Lower Siliceous strata. Towards the western side of S. 23 the surface show of iron ore becomes much better—and extends into Section 22 (S. E. corner.) Several small holes had been dug on it, at several places. At an early period of the mineral excitement, one mile in length of the lode, (or "lead" as it is called,) was sold to a speculator for twenty-five dollars per acre, being a strip one mile long, by a quarter mile wide.

As this property was considered very valuable, and supposed to contain a great quantity of excellent ore, it received very careful attention. A branch, or little stream of water, has cut through the Clinton near the principal exposures of the ore, and laid bare its entire structure. A sharp backed ridge runs south on the S. W. side of the branch, and E. N. E. on the other. The strike of ore does not conform to the trend of these ridges; but crosses them at an acute angle. Ore is therefore shown on both sides of the E. N. E. ridge, and on the top of the other. The dip is different on the two sides of the branch. On the N. E. side it is N. W. 18°—on the other side N. W. 70°. Hence there is not only at this point a great change in the dip, but the trend also makes an obtuse angle. But these though peculiar features, do not complicate the structure. The Black Shale shows on both sides of the branch, and from it the Cambrian Limestone is 100 feet surface measure. The change in the dip rendered it impossible to calculate the vertical thickness of the Clinton here with accuracy, but it is between 40 and 60 feet. The best show of ore is at the side of the branch—thickness 30 inches—24 inches of this solid, and uniform—will yield about 40 per cent. of iron—the other six inches inferior. Higher up the ridge, the same bed had again been opened on the east side. The bed is here 20 feet from the Black Shale. It is hence the upper bed or No. 1—measured

here nearly 30 inches, ore rather soft, carrying perhaps 35 per cent. of iron—Bed No. 2 not here—A shaly stratum of irony matter about one foot thick, seen only on the N. E. side, evidently represents Bed No. 3; of no value. On the western side of this ridge bed No. 1 again crops out; ore about the same as at the branch not cut through, and thickness unknown.* The trend of this ore is evidently towards the fault in a S. W. direction and if it does not change after leaving the ridge, it cannot possibly run far in that direction. On the south side of the branch the rocks are naked from the ore bed almost to the fault. Only one bed of ore exists here—the same one seen on the other side. It here measured 17 inches—35 per cent. of iron.

Two hundred yards S. W. from this branch is a good exposure of the Black Shale, and the strata beneath it for twenty yards. But very little of these strata could be identified as Clinton. It was certainly the crumbled debris that filled up the fault, where the Clinton had sunk. No ore fragments even, could be found here, or in any part of the low ground. For half a mile to the S. W. the line of the fault is marked by a depression between the Cambrian Limestone and the Lower Siliceous. It is not believed that any iron ore or even Clinton strata will be found there. On a higher point which juts down into this depression, an opening had been made and some ore evidently of the upper bed, had been taken out. It was evidently not thick. In another pit dug on the same line but on lower ground it was not found. No further indication of the existence of iron ore, was found on this tract. It is therefore evident that nearly all of the available ore, contained in this greatly over-rated property, lies within a hundred yards, or less, of the branch which cuts through it. That the average thickness of its single bed is less than 2 feet of ore.

In the S. E. ¼ of S. 22 same Tp., the Clinton strata became still thinner, surface distance across it 50 feet, and in

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*Since this was written several cuts have been made here—ore 1 foot thick, and much faulted.

the S. E. ¼ of the S. E. ¼ it sinks beneath the surface. The upper bed of iron ore was found on this tract, about the same thickness and quality as in Sec. 23.

At the point where the last of the Clinton passes beneath the surface, a new member, not heretofore seen in this valley, is largely exposed. It is the *Keokuk Limestone* of the Lower Siliceous formation. It is here, at once a heavy member, and though its geological relations cannot be seen here, yet it continues into section 27, where its relations are clearly seen. This member might, from its appearance, be very readily mistaken for the Carboniferous or Mountain Limestone—and if seen only at this point, would be so regarded, even by sharp-eyed geologists. But when traced farther its position is seen to be beneath the LaGrange or Oxmoor Sandstone, and just above the Black Shale, and hence a member of the Lower Siliceous group—its lowest member. It is here a very pure semi-Crystalline limestone—about 100 feet thick.

On entering Sect. 27 in the N. ½ of the N. E. ¼ we pass directly from the top of the Keokuk Limestone on to the top of the Clinton—the former having been lapped over on the latter, for the last half mile. The Clinton is here in a high narrow ridge. Some iron ore of good quality is seen in it, belonging to the 1st and 2nd beds, but the quantity is inconsiderable. The ridge has the appearance of being principally made up of Clinton strata, and the distance from the 1st ore bed to the first Cambrian Limestone, is over 200 feet. This with a dip of 45° would give it a thickness of over 100 feet. But no other beds, or fragments from them, could be found. It is probable that the Limestone comes much closer here than it appears to do, and that it is covered over by debris from the Clinton. This is seen to be the case 200 yards to the S. W. The Clinton here becomes very narrow—not more than 50 feet thick, and in the S. W. ¼ of the N. E. ¼ it is yet much thinner. A stream cuts through it (the Wade Gap stream) near this, or in this tract. The rocks are exposed, and gave the following section, as measured at right angles with the strike:

Section in S. 27, T. 13, R. 1 E.

Black Shale Dip 45 N. W.

Hard seamy sand rock......................................		15 ft.
Shale and soft rock...		11 "
Iron ore No. 1..........................	8 in.	
" 2........................	2 "	
Shale.		
" 3 ....3 to	4 "	7 "
Shale.		
" 4........................	4 "	
Shale.		
Shale and debris.		
Whole thickness of iron ore.	18 in.	
Total thickness of Clinton...............		33 ft.

It seems that the Clinton diminishes in thickness in proportion to depth, and proximity to the fault, at least, at this place. Through the remainder of this section, no ore beds, or any evidence of their existence, were found. They seemed to have been entirely swept away.

In the E. ½ of the S. E. ¼ of Sect. 28, same Tp., a good show of ore is presented on several high points. It was principally from bed No. 1—ore of average quality. The pits which had been dug on it, were filled up, and its thickness was not seen. The existence of bed No. 3 was also shown by the outcrop, but it had not been opened. From appearances the top bed was supposed to be 2 to 3 feet thick, the other, less probably than two.

Through the N. W. of the S. E. of Sect. 28 there is evidence of the existence of iron on the high points—though very little of it was seen. Through the remainder of this Section the Lower Siliceous joins the Cambrian Limestone, sometimes lapping over on it. Occasionally the LaGrange Sandstone is seen close to the limestone. In all such places the Clinton has gone down in the fault. This arrangement continues to the Township line, and in a greater, or less degree, to the middle of Sect. 6, T. 14, R. 1 E. Through the space thus passed over, though some ore has been found,

yet the beds are not continuous, and are so deranged by the irregularity of the strata, as to be of uncertain value.

From Sect. 6, T. 14, R. 1 E., to Sect. 5, T. 13, R. 2 E., a distance of nine miles, the fault which cuts off the Clinton in its N. W. side, is evidently deeper than in any other part of the valley. The Clinton is often split off and divided, or entirely sunk, and seldom rises so high as not to have its lower parts denuded away. Hence the many breaks, and gaps, and irregularities observed in that portion of the valley. This irregularity does not entirely cease till the middle of S. 7, T. 14, R. 1 E. is reached.

In S. E. corner of S. 6, T. 14, R. 1 E. a small ridge of Clinton strata, which only runs a short distance, makes a very good show of ore. In about 100 yards this is covered over with the talus of the newer strata. Probably it again sinks, as otherwise it might be again seen a quarter of a mile farther on. For the space of the next quarter or half mile it cannot be known, with our present means, whether or no, the Clinton is above the level of the valley, as the whole surface is deeply covered by detritus of the Coal Measures, brought down by a small stream which cuts the Straight Mountain opposite this place.

In S. 7, T. 14, R. 1 E., begins a prominent ridge of Clinton, which continues with slight gaps to Sect. 13 of T. 14, R. 1 W. This is a high ridge, and contains a very fine body of Red Hematite ores. In the N. E. of the S. W., on the lands of Mr. Hullett, the best view of the whole structure was obtained. A little stream had here cut through the Clinton ridge, exposing in part of its course, the naked rocks, and one ore bed. Several pits had also been dug, and three beds were well exposed. The two upper beds had not been searched for; and they were not observed in the bed of the stream, being probably covered by loose rocks. Their existence here is certain; many samples, especially of No. 1, were found on top of the ridge—and its position was there plainly shown on the surface. A few samples of No. 2 were also picked up, but the bed here is evidently not prominent. At this place the Cambrian Limestone so far as could be

seen, did not approach close to the base of the Clinton ridge. Some limestones, which did not posses its characteristics, were seen near this place, lying between it and the Clinton. They were assumed to be Trenton limestone. If this is correct, then the depth of the Clinton, before reaching the fault, is greater here than in any other part of the valley. And its ores here will reach far below the water level, while in many parts that have already been described they scarcely reach to it.

A section through the Clinton, shows at the Hullett gap, the following measurements:

From Black Shale to base of 5th ore bed, 175 feet—surface measure.

1st and 2nd beds not seen.

3d bed solid, first-class ore..................	9	feet.
Rock, and earthy material.................	50	"
4th bed, limy ore, dark crystallized.........	5	"
Shale, and probably rock	15	"
5th bed, soft, fine grained, dark ore.........	14	"
Lime-rock.		

Some doubts naturally arise on the classification of the ore beds at this place. That they stand, as here shown, is self-evident. But if the one marked 3d be *really the 3d bed*, it carries here an ore *very widely different* from what it does elsewhere. The ores of the 4th bed are also different from what it *usually* carries, and partake of the character of the fifth bed. Yet we must accept their position, and anomalies here, or *assume*, that the 3d bed has disappeared and that the 5th bed has been divided and the two parts separated by 15 feet of strata. This would tend to harmonize the contents of the beds here, with what obtains elsewhere. But we have as yet, no facts to support this assumption. And hypotheses, or assumptions, unsustained by facts, do not pass current in geological investigations. These doubts must therefore hold till farther development places aditional facts within our reach.

The ore of the bed marked 3d is mainly linticular with occasional round grains, dark brown to blue steely grey—

solid yet pulverent—judged to carry 12 to 14 per cent. of Silica, and about 50 per cent. of metallic iron. Its association here, with the 4th bed of good limy ore, is probably of considerable economic interest. The 4th bed will furnish lime enough to flux itself, and most of the 3d bed also.

This is the first time the 5th bed has been seen in any appreciable quantity for twelve miles. Its ore is such as it usually carries, rather soft where opened, but will probably be harder when better roofed in.

The height of the ore ridge is from 125 to 150 feet. All the way up its face large quantities of ore are exposed on the surface, mainly from the 3d bed. Near the top of the ridge this bed seems to be much thicker than at the base, this may be only apparently so—yet such a thickening upwards has been seen in many places heretofore. Along the top of this ridge samples from the 1st bed with their characteristic fossils were not uncommon. It had not been opened, and its existence had been overlooked. A little farther, say from a quarter to a half mile N. E., at the base of the ridge, an opening had been sunk down to the 4th bed, its thickness here could not be seen, and it showed no special features.

S. W. from the Hullett gap in the same ¼ Sect. was found another little gap on the lands of E. J. Cozby that exposed part of the structure. The 3d bed here measured 10 feet, but with irony clay parting 3 feet thick in the middle. A large portion of the space between the 3d and 4th beds is here filled with iron limestone. It could not be accurately measured, but is about 50 feet thick—then sandstone 4 feet. Then iron limestone of better quality than the upper ledge 22 feet. Beneath this, a partly exposed bed of soft, dark iron ore—*the 5th bed;* thickness unknown.

It is wonderful that in the short space of quarter of a mile the limy 4th bed, 5 feet thick, should expand and loose itself in such a mass of iron limestone.

Through the remainder of Sect. 7, iron ore shows profusely on the surface, and in all the little hollows in this ridge. The third bed is generally prominent. But iron ore

varying from the size of small peas to sorghum seed, imbedded in it. This ore is above the average in grade. It resembles the great bed at Turkey Creek, but is not quite equal in quality. The natural drainage here is perfect, and the advantages for mining are all that could be desired.

On the slope of this ridge to the S. W. this bed has been removed. Its out crop is very plainly seen on the N. W. side of the ridge, but it had not been opened on that side. Several prospect holes had been sunk to strike this ore at other places, but for want of knowledge of the changes of dip they were improperly located. In one of these another bed was struck, which may be the 4th bed. It was too much filled up to get its dimensions, or judge fairly of its quality. Lower down and near the foot of the slope, at the S. W. end, ore had been found in several places of the same quality as the big bed above. They were probably slides, but so abraded as to hide their relations. Between them and the big bed was the evident out crop, of what was regarded as the 4th bed. Two hundred yards, or about that distance, from this out crop, S. S. W. on the N. W. ¼ of N. E. ¼ of S. 26, at a lower level, an extensive pit had been dug, uncovering the 5th bed. No ore was seen, as the dirt had partly filled up the pit. But the information obtained from the citizens, who had seen the pit dug and the ore measured, was that "the pit was sunk to the ore and it was uncovered to nearly the whole length of the pit; that it measured across the bed 22 feet." The ore was represented as soft, fine grained, and very dark colored. These are the general descriptive points of the 5th bed. There was nothing shown here by which the dip could be ascertained, and hence the actual thickness of this bed here could not be determined. No iron limestone seen here.

A little farther S. W. on the same tract of land in a ridge flanked by Lagrange or Oxmoor Sandstone on the South, some good pieces of manganese ore were found, and a larger show of manganiferous limonite ore. Probably both exist here in sufficient quantity to be of value. The indications are sufficient to encourage the labor of testing.

Just below the body of iron ores last described, the Clinton sinks again beneath the surface. For a mile it is entirely engulfed, and the greater part, sometimes all, of the Lower Siliceous also. The LaGrange and the lower members of the Silurian (Knox) Chert join together at the fault.

Opposite this sunken portion of the Clinton, in S. 26, the LaGrange or Oxmoor Sandstone is a very massive, vertical ledge, through which flows that branch of Village Creek which rises in Spradling's Cove, or "Wild Cat Cove" as it is often called. The region up this branch presents some very notable features. On the left or eastern side is a large exposure of Carboniferous or Mountain Limestone, flanking the south western end of Raccoon Mountain Coal Field. A vertical thickness of about 200 feet of the limestone is shown here, and much of it of very good quality. Its base covered by talus is nowhere seen from the edge of Murphree's Valley to Wild Cat Cove. While on the opposite or western side of the branch at the same level is found only Lower Siliceous rocks and LaGrange Sandstones. And a half mile farther west the LaGrange is at a higher level than the opposite limestone. A very considerable difference of level produced either by fault or flexure exists here. On entering the Cove still greater complications of strata are seen. The floor of the Cove is of Carboniferous Limestone, and Lower Siliceous Chert; its western margin of LaGrange Sandstone, its eastern and southeastern side is Trenton Limestone and Clinton Strata, both vertical at the edge of the Cove and also showing much difference in level at different points. On the lands of George Chamblee in S. 11, T. 15, R. 1 W., on a seam of iron ore, the difference of level is over 100 feet in a space of 125 yards. The identity of the seam as seen at both places could not be mistaken. Both places showed about the same thickness, the same ore, the same underlying rocks. On the east side, where it was dipping very gently to the northwest, the bed was well exposed, showing upwards of four feet of soft, fine-grained, dark colored ore, a little better in quality than the general average of this bed. There is no question of its identity. This is the 5th bed, and

although only a little over 4 feet of ore was shown, yet it also carries a considerable thickness of pulverent, irony matter, which probably will be solid ore farther in. Above it, though not in close contact, was a good thickness of irony limestone, and above that another bed of iron ore about 3 feet thick of average quality. These were the only beds found in this section. But they were found in nearly all the numerous exposures of Clinton, which this Cove, and Clayton's Cove, farther to the South, present.

The region of these Coves is crossed by many faults trending in different directions. They are too numerous to admit of clear description. Two of these are prominent between Clayton's Cove, and Spradling's Cove. Their trend is N. E. and S. W. The N. W. side of each is heaved more than the whole thickness of the Clinton. It hence faces the S. E. and dips N. W. till the next fault is reached. It again is thrown up above the surface with a N. W. dip. Thus a double exposure of the Clinton is given in that portion, and a great amount of iron ore is rendered available. This N. W. dip terminates at the vertical Trenton and Clinton strata, heretofore noted at the S. E. edge of Spradling's Cove. A fault trending nearly N. and S. for a short distance, exists here, with several hundred feet of displacement of strata. Between this fault and the great Murphree's Valley fault, the dip is southeast. Spradling's Cove is an *area of depression*, the meeting line of the N. W. and S. E. slope, and yet it is floored with sub-Carboniferous strata, while Silurian strata rises high above it on both sides.

It may be here remarked that the whole region, embracing Spralding's, and Clayton's Coves, and their out lying ridges—in the fork, or biturcation of the great Birmingham and Cahaba valley, is a region of *much faulting, and diverse displacement*. Yet the stratum brought prominently to the surface by these faults, and displacements, is the iron bearing Clinton. And that in consequence of these faults a vastly greater breadth of ore, can be reached, and a much greater number of productive mines can be operated, than if these faults had not existed. This region is destined to be a rich

mining region; a busy field of productive enterprise. Only transportation is wanting to make its mineral treasures available now.

We resume the description of the Murphree's Valley ores at the point where the head waters of Village (Gurley's) Creek break through the vertical wall of LaGrange Sandstone, in S. 26, T. 14 of R. 1 west. This appears to be at, or near the south west end of this peculiar structure—this minor fold. It terminates opposite the termination of the Blount Mountain Coal Field. From this point south-westward for several miles this valley is a single fold—a simple anticlinal with the great fault at its apex, and the strata dipping from it, to the S. E. and N. W. The fault is now a little closer to the S. E. edge, or side of the valley, than heretofore, and its position is often obscured by the drift and talus from the mountain. The Lower Silurian (Knox) Chert on one side, and the Lower Siliceous (Sub-Carboniferous) on the other give a close approximation to the dividing fault line. No Clinton seen along the line till the N. E. ¼ of S. 34 of this Tp. is reached. About a half mile east of Village Springs, on the top of a high sharp ridge, the upper members of the Clinton again come to the surface. The well known 2nd seam of fossiliferous, or Encrinital ore is here standing above the surface. On top of the ridge it is almost vertical, and gradually changing to a steep S. E. dip farther to the south-west. There is here not only a steep S. E. dip, but also a rapid declination of the ore bed to the south-west. On the descent the First, or top seam of the Clinton, becomes also exposed. These two seams are close together, though not united as they are at the Worthington Mines in S's 22 and 28 on the opposite side of the valley. And with the further difference that the 2nd bed here is much thicker, and is first class ore, carrying 55 or 6 per cent of metallic iron, while the first or top bed is probably a little inferior. But as no openings have been made here, a reliable opinion of quantity or quality could not be entertained.

East Red Mountain begins at the gap where the Village Springs and Spralding's Cove road crosses the mountain, or

rim of the valley. South-west from that, the Clinton is found capping the mountain, and the Trenton Limestone making its base. The mountain is thence regular in its structure, and in all respects similar to the western or main Red Mountain of Murphree's Valley. From Village Springs its trend is S. S. W. to S. thus very materially increasing the width of the valley below that place. For a few miles it is a well defined ridge, or mountain, but becomes broken up into knobs, and detached fragments, and disappears in the bifurcation of the valley—in that broken up region heretofore referred to, lying between the north-eastern, and south-eastern prolongations of Jones' valley. The Red Mountain, or Clinton-ridge *terminates*, but the whole region lying between the forks of the valley, and the terminal end of Raccoon or Blount Mountain, *is its equivalent*, and is mainly composed of Clinton and Sub-Carboniferous strata, much disrupted, but possessing admirable economic relations. It holds the same iron ore beds, carrying about the same *quantity* and *quality* of ore that we have previously seen in this formation.

In this region are also exposed large quantities of the flux rock, the Carboniferous or Mountain Limestone. It is presented in large volume, in, and north of Spradling's Cove; north east of Clayton's Cove, and east of Clayton's Cove, in Bear Mountain, which is almost wholly composed of Carboniferous Lime rock, and has also much *Calcite*, or pure Carbonate of lime.

We close our description of the east Red Mountain, with one sample of its ores as characteristic of the whole—taken in S. 3, T. 15, R. 1, W. on the main mountain separating Spradling's Cove from Jones' Valley.

An opening had been made here near the top of the mountain, on its western side, by John Rickles, who had long been a trusted agent of the Sloss Furnace Company. The opening was cut squarely in, on bed No. 1 of the General Section, and showed nearly three feet of good ore, about average quality for that seam. Dip 40° to S. E., crossing over the top of the mountain to the S. E. The slope of the mountain was found to be about 50° to the perpendicular. This slope

being greater than the dip of the strata, soon brought the ore bed No. 1 to the surface on the S. E. slope of the mountain, where it was exposed in the gullies and washes on its sides. It is near the surface all along the S. E. face of the mountain, and could be easily mined by stripping and surface working. The quality of the ore here is good, carrying about 50 per cent. of metallic iron.

The underlying beds were not fully exposed at this place. Openings had not been made on them, but the surface showings very clearly indicated their presence.

ESTIMATES.

We have now passed over the bounds allotted to this examination, and noted in detail all the prominent exposures of Red Hematite ore which it contains. These detailed descriptions aimed at strict accuracy, so far as they went. Yet they necessarily fail to give, even if they could be all enumerated, a clear and comprehensive idea of the total amount of ore contained in the region described. In attempting to show the quantity of ore, general terms had to be used. Quantities were said to be *great*, *very great*, *vast*, *inexhaustible*, etc. These terms are always indefinite, and many convey different meanings to different minds. To make the quantity of ore described clearly comprehensible by all, measurements made at various places must be aggregated, and computations made of the gross amount.

Beginning then where description ended, in the upper part of Jones' Valley, say at Turkey Creek, there are there 29 feet of ore, the same at Village Springs, and probably for a good distance above, and making on that side for 10 miles an average thickness of say 15 feet. On the other side it varies in the same distance from 7 to 30 feet, and taking in the gaps will give an average for the 10 miles of at least 5 feet, making total aggregate thickness of both 20 feet. This may be considered as equivalent to a body of ore 10 miles long and 20 feet thick. Much of this ore can be advantageously mined up the slope of the mountain for half a mile, but assuming a quarter of a mile to be the average extent of

profitable mining. Each mile contains 5,162,666 cubic yards of smelting ore, and the 10 miles 51,626,660 cubic yards.

The specific gravity of this ore is from 3 to 4, usually 3.8-10. Estimated at 3, it weighs over 2½ tons to the cubic yard, or 12,906,665 tons per mile. Each mile would supply a 100 ton furnace, in constant blast, with 200 tons per day for 176 years. And assuming the net product of iron to be 45 per cent., would yield over 5,800,000 tons of iron, which at present prices would represent a gross valuation of over $116,000,000, or for the 10 miles from Turkey creek to the Blackburn Fork of the Warrior, a total gross value of $1,160,000,000.

To avoid any appearance of exaggeration in this calculation, the Cove ores were omitted, the beds assumed to exist *only* where already seen, the mining area put below the actual, and the specific gravity of the ores taken over one-fifth too low. These it was thought would more than counterbalance the amount necessarily left, and wasted in mining.

For the next 20 miles the ore is more uniform, though of less aggregate thickness, in the Red Mountain. But it is higher, and the extent of slope up which it may be mined is increased. In this portion it may be reckoned at 600 yards, or 1,036,800 square yards per mile. The beds show an aggregate of 5 to 11 feet. Assuming them only to average 5, and that the iron ore on the S. E. side would only add 1 foot to this, or a total for both sides of 6 feet, and that the specific gravity is, as before, taken at 3. Then this area contains 42,240,000 cubic yards of ore, weighing over 105,600,000 tons. Sufficient to run 10 hundred-ton furnaces, or one every two miles, for 145 years.

The next ten miles have not yet been sufficiently opened up to be estimated, but they will add something to the general aggregate, if they only add an amount equivalent to two miles of the preceding area, or 10,560,000 tons. Then this valley holds by estimate over 245,226,650 tons of Red Hematite ore, with a spot cash value, at 15 cents per ton royalty, of over $21,000,000.

The amounts are beyond the grasp of the ordinary mind,

but they are more tangible than the general descriptive terms *vast*, *unlimited*, *incalculable*, and the like so often employed.

The brown ores will be next considered.

Brown Iron Ores—Limonites.

There are six (6) different horizons in this valley that carry *Brown Iron Ore*, or Limonite Ore, as it is more properly called. These, beginning with the lowest, and most important are:

1. The base of the Knox Dolomite, or base of Lower Silurian.
2. A little below the middle of the lower half of the Knox Dolomite, or 400 to 500 ft. above its base.
3. Near the top of the Knox Dolomite, but below the "Birmingham Breccia," where it exists.
4. In the base, or lowest member of the Trenton.
5. Near the top of the Siliceous Group, and beneath the LaGrange, or Oxmoor Sandstone.
6. The top of the Sub-Carboniferous, or Mountain Limestone.

The ore is not stratified, or generally continuous for any great distance. It exists mainly as deposits, and these often widely separated. But wherever found in large or small quantities, in this or any of the other Silurian Valleys of Alabama, it is in one or other of these six horizons, and never scattered through any intermediate formation. Hence bearing this important fact in mind, the hidden deposits of this ore may be as systematically searched for and found as the beds of the Red Hematite ores.

When it is remembered that all, or nearly all, of the brown ores that are known have been exposed by natural agencies alone, it can hardly be doubted that many more yet exist unknown, but which may be revealed by properly directed search and effort.

For the purpose of showing where the brown ores may

be searched for with hopes of success, a more detailed description of the several horizons is given.

The First or Lowest Limonite Horizon—Is the top of the Upper Cambrian or base of the Lower Silurian. The top members of the Cambrian are usually heavy bedded, massive, siliceous lime rocks. Sometimes in this valley these are covered by a thin member of coarse, rusty colored sandrocks. Above this, in the Lower Silurian, but conformable to the underlying Cambrian, is the Lower Limonite horizon. No iron ore is found beneath this in our Silurian valleys. While the oldest member of the Knox Dolomite, or Lower Silurian is iron-bearing, the iron occurs in available quantities only in certain localities.

This ore is usually associated with, and imbedded in, large quantities of irony clay, or dark red ochre. Hence its presence in some quantity may be anticipated, wherever there is much of the latter, even though there is little or none of the ore exposed on the surface. The exposure of the base of the Silurian is along only a narrow belt in this valley, hence many exposures of this deep lying ore could not be reasonably expected. One of these, and the most prominent, is on the Township line between Tps. 12 and 13 of R. 2 East, and known as the *Champion Mines*. A detailed description of these will be given hereafter. From Champion Mines the ore may be traced along the base of the Silurian towards the S. W. to S. 22, T. 13 of R. 1 E., where strong indications are found of the existence of an ore deposit, though it does not show on the surface.

In S. 34, T. 14 of R. 1 W., near Village Springs, a body of brown ore is found, but as the Cambrian rocks do not there come to the surface, it is uncertain whether it belongs to this horizon, or the next one above. Also a deposit near Palmer's Station is left unclassed for the same reason.

At Mt. Pinson the Cambrian rocks are again exposed, and this iron bearing horizon is also largely exposed for several miles to the S. W., and gives fine indications of holding bodies of iron ore. Good ore has been seen on the

hills around here at the corresponding level, and shot ore is seen in the gullies on the red hill sides. Hence the expectation that bodies, or deposits of ore may be found in this region, may be reasonably indulged.

The Second Limonite Horizon—Is also in the *Lower Silurian* or Knox Dolomite formation, about 400 to 500 feet above its base. The intervening space between these horizons is mainly destitute of iron.

This horizon makes its appearance much farther to the northeast in this valley than the former one. At the higher level where this portion of the Silurian first comes to the surface, in S. 18, T. 12 of R. 3 E., is a good exposure of it. Much ore is here scattered over about 40 acres of surface. Some of it very good ore, equal to the best. Some very impure, heavily mixed with chert, yet showing an amount of available ore of fair quality to invite development. It may be, probably is, much more extensive than is shown by the surface ore. The gentle slope of the hills here make it almost certain that the ore body, 50 to 75 feet thick, may carry available quantities of ore much farther than it is seen on the surface.

This belt, or horizon of ore, next makes its appearance on the Foster and Robinett places, in S. 13 or 14, T. 12, R. 2 E., and extends thence to the Byrd place in S. 22, T. 12, R. 2 E., nearly South of Hood's Cross roads. It here attains its greatest volume, or thickness. Certainly one hundred to one hundred and fifty feet. Much ore is shown on the surface, and the quality is almost equal to the first horizon at *Champion Mines*. But the ore is more scattered through a great mass of irony clay and ochre. The hills, almost wholly composed of this material, rise to the height of 100 to 200 feet above the valley. That much valuable ore exists here, is very evident, but whether the proportion of ore to the surplus mass of waste material is sufficient to make mining profitable, remains yet to be demonstrated. From this point towards the S. W. this belt of iron bearing strata diminishes in volume. It shows itself again in S. 31,

T. 12 of R. 2 E., in several ridges of ferruginous material, but carrying only occasional chunks of Limonite ore of no economic value. From thence south-westwards it is only an irony belt of chert rock.

The Third Limonite Horizon—Shows itself first still farther to the N. E. than either of the preceeding horizons. Its first prominent exposure is on the lands of Eli Bynum in S. 7, T. 11, R. 3, east. It is there an iron bearing stratum, probably 40 or 50 feet thick, and carrying small chunks of good limonite ore. The quantity apparently insufficient for profitable mining. From there it can be easily traced south-westward for a long distance. Its exact position in the Silurian Chert formation is not so easily defined as the preceding horizons. There are no prominent rocks or ledges here to mark its position. The nearest approximation to its position is from 100 to 150 feet below the lower Conglomerate, or "Birmingham Breccia."

It is less prominent, but *more persistent* than either of the preceding horizons. It may easily be traced for the greater length of this valley. In some places it carries limonite ore, in others *red hematite*. In some places both *limonite and hematite are found together*, while in many others there is no ore, and only a thick belt of irony rocks marks its position. Usually in the upper part of this valley both the limonite and hematite deposits and beds are thin, and may not carry ore enough to be of economic value. But I am informed by a note from Dr. E. A. Smith, State Geologist, that in the lower part of the valley a bed four feet thick in one place of red hematite ore has been found in the Lower Silurian at Pratt's Ferry in Bibb county, and has been traced to Birmingham. It belongs either to this horizon or the next above it, the base of the Trenton. No others carry red hematite ores, so far as yet observed.

The Fourth Limonite Horizon is in this valley unimportant, as it carries but little ore. It is the base of the Trenton formation, or rather the magnesian limestone, which often

makes the base of the Trenton. At a few places along this line, limonite ore has been found; and in at least one place in S. 20, T. 13, R. 1, E., in such quantities as to leave no doubt of its being a belt or horizon of limonite ore. The ore bed here, though not very extensive, is peculiar in carrying a mixture of *limonite and turgite* combined. Also in S. 28, T. 14, R. 1, W.. near Village Springs, good limonite was found, which could only be referred to this horizon.

The Fifth Limonite Horizon is more important. It is the upper part of the Siliceous Group of the Sub-Carboniferous. The belt carrying ore does not seem to be continuous here, but in a few places it carries large amounts of good brown ore. One of these places is in S. 16, T. 12, R. 2, E. Ore of very fine quality exists here, and in quantity sufficient to establish this as a brown ore bearing horizon. It was seen at many places along Sand valley, at or near the base of the LaGrange Sandstone; but the most prominent deposit of it occurs on the S. E. side of the valley in S. 5, T. 13, R. 2, E. It exists here in great volume between the Sub-Carboniferous Chert and the LaGrange Sandstone. Some of it is very cherty and impure, but much of it, especially the lower portion of the ledge, is excellent ore. Its surroundings here clearly show that this is Sub-Carboniferous ore, though, by faulting, it is thrown in close proximity to the Silurian ore of horizon No. 1. It is also seen at the base of the iron ridge in S. 33, T. 12, R. 2, E., associated with the same Sub-Carboniferous rocks, and showing the same characteristics.

The Sixth Limonite Horizon is the top of Carboniferous or Mountain Limestone, or the base of the Sub-Conglomerate Coal Measures.

Almost continuously along this line is found a belt of brown ore, though seldom in quantity sufficient to be of practicable value.

The iron ore in this horizon is often good limonite, but generally sandy; and in many places replaced by carbonate or spathic ore, some places in considerable volume. This

horizon is so well defined and easily recognized that further description is unnecessary.

Details.

In the further descriptions of the brown ores of this valley they will be referred to their proper horizons, in connection with the locations in which they are found, and in consecutive order from the head of the valley to its S. W. end.

That portion of the valley lying N. E. of the Locust Fork of the Warrior river, called *Bristow's Cove*, exposes no brown ores on the surface. They very probably exist there as in other parts of the valley, but the uplift there has not been sufficiently great to bring the main brown ore bearing horizons to the surface.

Only on the west side of the cove, at the foot of Sand Mountain on lands formerly belonging to Levi Murphree, deceased, there is a large show of spathic iron. It belongs to the 6th Limonite horizon. If the 5th horizon carries brown ore here, it is covered up by the drift and silt of Sand valley, and does not show on the surface. The oldest rocks exposed in the Cove is the top of the Trenton, hence the great brown ore bearing strata can not be seen.

On the S. W. side of the river, about one mile south of where it cuts the rim of the valley, in S. 9, T. 11, R. 3, E., on the face of Sand Mountain, there is a good show of good brown ore. It belongs to the upper or 6th horizon. The quantity, as shown scattered along the face of the mountain, and its quality exceeds what is usually found in this horizon.

In S. 15, T. 12, R. 3, E., on the lands of Wiley Bynum, is a deposit of brown ore of considerable extent, but uncertain thickness. It is generally very good ore, imbedded in rich red ochre; bed not cut through, or any exposure made that would show its thickness, or give any approximate knowledge of the quantity of the ore. So far as cut into, it showed chunks of small size, smooth and regular, and shot ore with but little admixture of chert or rock. This deposit belongs to the third horizon.

A little farther to the S. W. in S. 18, T. 12, R. 3, E., is a

very promising exposure of brown ore belonging to the *second horizon*. While some of it is very cherty and sandy, yet much of it is good. No openings had been made on the deposit to show the condition of the ore underground, or to what extent it may be mixed with rock or gravel, or the proportion of ore to the mass of matter. These matters could not be determined by inspection of the surface; yet the appearances indicate that it is a valuable though not a large body of ore.

The same ore is again seen in S. 14, T. 12, R. 2, E. It is there in much larger masses and greater volume, and again in S. 22 of the same township, where it is largely developed. High, red, ochery hills, apparently carrying brown ore, extend still farther to the S. W. and W. But little ore was seen, however, on their surface, and notwithstanding their irony appearance they may not be ore bearing.

Another small body of brown ore is found about one mile to the west of the last locality, in S. 21, T. 12, R. 2, E. It is not a thick deposit, and may not be valuable. It belongs higher up in the series. It is in the third Limonite horizon, and the absence of the Birmingham Breccia at this place puts it near the top of the Knox Dolomite.

In the N. W. corner of S. 28, same Tp., this stratum of brown ore again is found in large sized masses, though most of it impure and cherty. And in several places in S. 29 it is found in good sized pieces of good ore. But probably no body of it is sufficiently large to be valuable. Near the S. W. corner of this section there is a prominent point with its surface nearly covered with limonite. The ore is of good quality, and it is probably the best show of ore that is known at this horizon.

One mile to the south of this is the great Limonite Ore deposit of the valley, once known as "*Iron Ridge*," but now designated and known as

Champion Mines.

This great deposit of brown ore belongs to the 1st Limonite Horizon, lying at the very base of the Silurian. Min-

ing has been progressing here for several years, operated by J. W. Worthington & Co., and under the efficient management of Dr. Walls. The mines are three miles eastward from ONEONTA—in S's 32 and 33 of T 12, and S's 4 and 5 of T 13, R. 2 E. The works are mainly in the adjacent S's 4 and 33.

Only two washers have as yet been started, these are supplied by water pumped into a large tank on the top of the ore ridge, and delivered by pipes to the washers as required. The daily out put is now about 300 tons which is shipped mainly to the furnaces at North Birmingham, by the Huntsville Branch of the Mineral R. R.

A Branch R. R. connects these mines with the present terminus of the Birmingham & Huntsville Mineral R. R., at Oneonta, and affords ample facilities for transportation. The ore of these mines by furnace test comes fully up to expectations. It carries less than 12 per cent. of silica—less than 25-100 of 1 per cent. of phosphorus, and yields from the furnace 56 per cent. of metallic iron. It is so easy of reduction, that the product of iron, in the small furnace at North Birmingham, is *15 tons per day, greater*, when using this ore, than when using any other that this valley affords.

These tests are practical, and every way satisfactory—they demonstrate that this is among the best, if not the *very best ore* found in Alabama.

A much larger out put of ore could be made here, did the iron market justify increased expenditure. An increased water supply, which has been arranged for, would enable the out put to be increased at will. The present water supply would not probably enable the company to greatly increase the product of well cleaned ore. Though by the use of *steam shovels* the out put was raised in 1891 to 10,000 tons per months; but as the ore was not always thoroughly cleaned, and freed from chert, they were discontinued.

These works carried on by J. W. Worthington & Co., have now been in operation over three years, and as yet they have made but a small impression on this great body

of ore. Only the top stratum, over a small area, has been worked. The greatest depth to which they have yet penetrated is 42 feet, and generally much less. The upper portion of this ore body, has the ore inclosed, or mixed with pulverent red ochery clay. Twenty-five solid feet of this mass yields one ton of ore on an average. This is about one-tenth in bulk of ore, but much more in weight. This light ocherous material is easily washed away, and the ore left clean.

Below this top stratum, of as yet unknown thickness, is another stratum, carrying apparently richer ore, but imbedded in tough, or unctious, red clay—hard to wash—the mining, or cleaning of which, has not as yet been attempted.

The foregoing notes embrace all the facts brought to light by three years mining on this deposit of ore.

A careful examination of all the exposed, adjacent and underlying rocks here, strongly impress the opinion, that this great body of iron ore occupies the site of a great basin, that existed here at the close of the Cambrian Period; and was filled in at the beginning of the Silurian Epoch. The extent, or form of this great basin, holding the deposit under consideration, can not yet be determined, or approximated. We can not learn from the exposures made, whether the axis of the basin conformed in any respect, to the axis of the uplift. Or whether the great fault which sheared through it, with much displacement, cut it in the *middle*, or on the *eastern* or the *western* side. Only of one thing can we be certain, that the axis of uplift, and the great fault heretofore described, cut this deposit from N. E. to S. W. for about a mile and a half; and for that distance exposed it on its N. W. side. While on the S. E. side, the corresponding portions of the deposit, are sunk from 1,500 to 2,000 feet beneath the surface. It is also probable that this deposit does not extend *westward* much, if any, farther than the west line of section 5. Though the great mass of irony clay, in which the ore is contained, extends a considerable distance beyond this line, but little ore has yet been

found in it. Deep boring only can determine its limits in a N. or N. E. direction.

It has been suggested that this deposit does not extend in a S. E. direction from the S. W. end of section 5—because on the face of the hill on the S. E. side of a deep gorge, the Cambrian Limestone is exposed, and no iron ore is there in connection with it. This is not conclusive evidence, the great fault is at the S. E. edge of the Cambrian Limestone, not at the gorge. Denudation here, as in many other places, has not followed the line of the fault. And the deposit of iron ore has here been swept away from the line of the fault, to the bluff on the opposite or S. W. side of the gorge. A similar condition of things exists a mile to the N. E. in section 4, where the principal denudation is *S. E. of the fault*, in the LaGrange sandstone—leaving a portion of Lower Siliceous, and Clinton strata, at the fault, *in direct contact with the great deposit of lower Silurian limonite.* It would also be an unreasonable supposition to conclude that this great body of ore was terminated by the fault on the S. E. side. That would be such an abrupt ending, as would be inconsistent with the laws governing sedimentary deposits; and such as has no where been seen in any other strata.

In the S. W. ¼ of Sect. 5 the best, and only aproximate measurements, of this great bed were obtained. The top of the deposit is the best shown near the north line of that ¼ section. Thence is a gentle and unbroken descent, over the edge of the deposit, in a S. E. direction, for a distance of a little over 450 feet to the Cambrian rocks; difference of level by aneroid measure, 45 feet. The Cambrian limestone, on which the ore is bedded, here dips N. W. 60°. But this is believed to be an exceptionally steep dip. The members of that limestone here are *thin* and *shaly;* and it has been everywhere noticed in this formation, that the *thin members* have been crushed by the thicker, and more rigid ones, so that they dip at all angles. In estimating therefore the average dip of the strata, the dip of the thin shaly members must be disregarded, and the true dip of the strata obtained,

from the solid, heavy bedded, rigid members, whose dip is always found to be remarkably uniforn.

At other points the dip found was always less than at the edge of the iron ore. It varied from place to place, but was no where to be found less than 10°. The average dip is certainly more, but to avoid an over estimate, it was hypothetically assumed that the dip of the iron ore is 10° N. W. That would give from the edge of the limestone a descent beneath a horizontal line, of 100 feet in 450—the length of the slant surface. To this must be added the descent of the surface in that distance, 45 feet. Making the *whole thickness of the deposit 145 feet.* But it is also probable that the limestone at this point, has been pushed up above the ore bed. It has that appearance. If so, the bed is thicker by the amount concealed by the limestone. It is also probable that the top of the slope, from whence the measure was taken, had been denuded, and was not therefore the actual top of the deposit. From all evidence therefore afforded here, it may be safely assumed, that this deposit is *150 feet thick.*

A little to the S. W. of this place, the limestone does not come to the surface, and the out-crop of the iron ore extends much farther down the hill, and therefore shows a much greater thickness of ore; but how much of this might be due to sliding, could not be determined, and hence no safe estimate could be made here.

A quarter of a mile to the N. E. and near the middle of the same section (5) a wash has cut through the iron ore deposit. The limestone beneath it is slightly exposed on the S. E. side. This is the extreme N. E. end of the exposure of the Cambrian Limestone. The iron ore deposit has been denuded down to the level of the floor of the valley in a N. W. direction. Its out crop along this wash is mainly obscured by silt, and shows but little ore. The edge here is over 200 yards broad, from S. E. to N. W.

On the face of the hill to the N. E. is shown from 150 to 200 feet of the irony clay which mainly constitutes the ore bed. The whole face of the hill is composed of it, but for a considerable distance no iron ore was found in it, and only

occasional chunks for a quarter of a mile. It is probable that the ore here, if it exists, is beneath the surface, and just above the limestone which here occupies a lower level. That it rises again in the N. E. ¼ of Sect. 5 and N. W. of S. 4 and E. ½ of 33, is more than probable. The iron ore on these tracts shows boldly on the very top of the ridge and down for a considerable distance on its N. W. side. The ridge is about 200 feet high. Therefore either the limestone, the bed rock of the deposit, (for iron ore deposits always conform to their bed rocks), must be here pushed up, at least 100 feet above the base of the ridge, or the iron ore deposit must be assumed to have a very unreasonable thickness. All along this part of the ridge, the S. E. face of the deposit is masked, and the iron ore can only be seen near the top and on the N. W. side. The fault, as already noticed, is on the S. E. face of the ridge, and portions of *Clinton* and of *Sub-Carboniferous strata are lapped up against the face of the Lower Limonite deposit.* This effectually conceals the structure, and the probably underlying lime-rock. In this portion of the ridge, the ore is in larger masses, and in many places scattered more thickly over the surface, than toward the S. W. end. The breadth of the deposit exposed, and the quantity of iron seen, give no indication of the termination of the deposit. But the ridge sinks, and the Lower Silurian strata gradually close over it, toward the N. E. It is probable that the deposit extends farther, perhaps much farther in that direction.

It is much to be regretted that greater exposure or developments have not been made in this great deposit, especially as it is the only one of its age, yet known, in which iron ore is exposed, in this valley. Its ore is good throughout, none inferior; most of it the best of its class; it will yield throughout from 50 to 60 per cent. of metallic iron. A large per cent. of it is fibrous ore; in some places it is nearly all of this quality, in others, very little is seen. Taking the deposit all over, so far as yet seen, 20 to 25 per cent. of it is fibrous, or needle ore. It all carries less silica, and other

impurities, than is usual with limonite, and is therefore a very promising ore for the manufacture of steel.

Near this deposit on the S. E. side, is another deposit of limonite, which though locally adjacent to the Lower Limonite, is widely separated in geological position and time. It is the 5th deposit in the scale. It belongs to the Sub-Carboniferous horizon, just beneath the LaGrange sandstone. Its presence here adds much to the importance of this locality. And for the sake of greater compactness of description, will be presented here, out of its order, but in its association.

Immediately on the S. E. side of the great fault, in the S. W. ¼ of S. 5, T. 13, R. 2 E., is the exposed edge of a great deposit of limonite ore. On the N. W. side of it is a slice of Lower Siliceous strata, crumbled and comminuted, yet clearly showing the structure, and fossils of that period. A little farther to the S. W. the unmistakable Black Shale makes its appearance. On the South and Southeast of the ore, the LaGrange sandstone is plainly seen. The dip of all, as usual, is to the N. W. The geological position of this ore deposit is therefore demonstrated. The deposit appears to be about 50 feet thick. Though from evident slides on the S. E. side, its base could only be approximated. The upper portion of this deposit is generally too sandy. The larger portion of the ore is of that character for the upper eight or ten feet. Then a fair to good class of ore is carried, generally, in the remainder. The ore is not as uniformly good as in the Lower Limonite deposit, yet it has some ore equal to the best of that. Much of this ore is in large blocks and bowlders, and it is evidently more closely compacted, with less irony clay associated with it, than the other deposit. The larger blocks are generally near the upper part of the deposit, while near the base, it is in smaller pieces.

Southwest from this point it soon disappears beneath the surface, and but little of it is seen farther down. It probably diminishes in volume very rapidly in that direction. In the S. E. ¼ of Sect. 5 most of the deposit has been swept away, only a thin stratum of its base is occasionally seen.

Neither does it show in the W. ½ of S. 4, though it is probable that it exists here beneath the surface. But in the E. ½ of Sect. 4 and the S. E. ¼ of Sect. 33, T. 12, R 2 E., it again becomes very prominent. It appears to come out from beneath the Lower Siliceous Chert, and is lapped up against the base of the ridge of Lower Limonite. Thickness still about fifty feet. Its scattered fragments cover the low ground as far down as the denudation has gone. Its quality here will average better than in Sect. 5. It seems every way equal to the Lower Limonite, though generally of a lighter color, and showing less fibrous ore. Ascending the ore ridge at this point, one passes first over the thick outcrop of this ore for 50 feet vertical; next Lower Siliceous crumbled Chert 50 feet; then Clinton 50 feet; then Lower Limonite ore standing out of, and on the surface, about 50 feet more to the top. Heretofore it has been the opinion that the ore at the top and bottom of the ridge were the same. That the ore at the base had rolled, or tumbled from the top. Yet inspection of the surface would have shown that there are no masses, or chunks of ore, on the surface of the Clinton, or the Lower Siliceous; which would necessarily have been otherwise, if the ore at the base had come from the top. The inclination of the surface is such that masses of ore descending would have come to rest, on one part, as well as on another. Hence it might have been seen, even by those who did not understand the geological structure, that two different ore deposits exists here. But the deposit at the base of the ridge having been hitherto regarded as talus, has received no attention. Prospectors and specimen hunters have passed it by unheeded, or unaware of its existence. And yet it is one of the great iron ore deposits of the valley. It is true it extends N. W. only to the fault line. And that the N. E. and S. W. extensions of it may both be engulfed in the fault. Yet a mass of ore like this, 50 feet thick, and easily accessible, will not be overlooked in the future, as it has been in the past.

It is a remarkable freak of nature, which has here brought almost together, the *only bed* of lower limonite yet dis-

covered, and the *only valuable portion* of the 5th horizon, or Sub-Carboniferous Limonite. The *two best deposits* of this ore, which this valley contains, are here brought into such close proximity, as practically to make them one. The normal position of this Sub-Carboniferous ore is about 1,500 feet above the Lower Limonite, yet it is here brought to the same level on the S. W. end and 150 feet below it at the N. E. end of the exposure.

Another fact may be noticed, opposite the N. E. end of this limonite, a gap exists in the vertical wall, or edge of the valley, through which, and on the same level, can be reached several beds of coal, less than 1,000 feet distant from the iron. Thus making here a concentration of economic values, which probably cannot be paralleled. Should this coal prove suitable for the manufacture of iron, its apparent abundance and proximity to the ore, will give advantages for utilizing both in the vicinity, and greatly enhance their relative values.

In this great deposit of brown ore, there is no indication of any rock. It is a great mass of ochery, and ferruginous clay, with chunks, masses and particles of imbedded ore interspersed through it, apparently without regularity. In most places on the surface it is thickly strewn. If we should judge of the contents of the bed by the abundance of the surface specimens alone we should probably make an overestimate, for the quantity on the surface is mainly due to denudation, which has carried off the surrounding clay, and left the iron ore. In some places the ore is in much greater quantities on the surface than in others; this may only be due in part to denudation. Probably the ore lies very irregularly scattered through the bed, in bunches and pockets, as is always the case in limonite deposits. The proportion therefore of clay to the ore, cannot as yet be safely approximated. In a few places where it has been dug into for a few feet, the proportion was about 3 or 4 of ore to 1 of clay, but these were places carefully selected, to show as much ore as possible, and none of them had gone deep enough to

be certainly beneath the effect of surface accumulation. It is probable that throughout the deposit the proportion of clay to ore may reach 10 to 1 in bulk.

This deposit is the only one certainly known to exist in the valley at this horizon. There are, however, good indications of the existence of another, a few miles farther down the valley. Here is in S. 14 and 22 the exposed edge of a vast deposit of irony clay and ochre, rising into a hill or ridge 200 feet high, and occupying the same geological position as the Iron Ridge or Champion Mines, and nearly as extensive. Though no iron ore is seen here on the surface, yet the probability of its existence in some part of this ochery ridge might be reasonably expected.

That no other than the Champion Mines deposit of brown ore, of this age, has been exposed in this valley is not a matter of much surprise. Only along a narrow strip about half a mile wide and ten or twelve miles long is the base of the Silurian revealed, and its exposure made possible. Part of that great deposit happened to lie in that strip and was thus exposed to view. While other bodies of ore lying a little farther to one side would only have their edges of irony clay laid bare, and the ores all hidden by overlying strata.

On the western side of the valley in S. 20, T. 13 of R. 1 E., there is a body of brown colored ore in chunks and masses which would ordinarily be classed as limonite. But only some pieces or parts of each chunk yield the characteristic yellow streak and powder of true Limonite ore. Other parts give a yellowish red or a bright blood red streak like Turgite ore. Yet it has neither the color nor appearance of either *Goethite* or *Turgite* ore. It must be classed as an *incomplete Limonite*, carrying less than the normal amount of water of hydration. This kind of ore is not common, only a few specimens had been heretofore seen. Were it abundant it would be more valuable than Limonite of the same grade of purity, because containing, say 5 per cent. less combined water, it has a correspondingly higher percentage of hematite in a given weight of ore. This deposit

is exposed only over a space of 20 or 30 yards long, and apparently 15 feet thick. No excavations have been made on it, and no safe opinion can be given of its contents. Its place is in, or closely connected with, the yellow magnesian limestone, at the 4th limonite horizon, or base of the Trenton.

Other bodies of this ore may exist farther down the valley to the southwest. The red hills on the Reese, Cowden and Higginbotham places, strongly suggest its vicinity; but the base of the Trenton is here beneath the surface; denudation has not cut down to the iron bearing horizon.

Near Village Springs, in S. 28, T. 14, R. 1 West, where the base of the Trenton is seen good limonite in large chunks was seen, but the quantity appears to be inconsiderable.

Of the limonites lying at a higher level on the west side of the valley, the best out crop is in S. 16, T. 12, R. 2, E., on the east side of the Calvert Fork of the Little Warrior. Large masses of very good ore are seen here in close connection with, but below the LaGrange sandstone. The ore is very dark colored, apparently carrying some admixture of manganese; this would reasonably be expected as this the 6th limonite horizon very nearly coincides with the manganese horizon in this valley. The ore bank has not been opened, and the natural exposure of ore is not sufficient to warrant the expectation of a large bed of it existing here. A few miles to the S. W., at this horizon is found a persistent bed of red chalk or red slaty ore, which seems in the main to have replaced the limonite. The ore is a lively red color, firm, slaty structure; smooth, fine grained, with silky lustre. It would be valuable if sufficient quantity exists, but so far as seen the bed or seam was only from six to eighteen inches thick. More or less of it was seen for two miles along Sand Valley, but mainly in S. 25 T. 12 R. 2 E. South west of this section none of it was seen, only small bunches and specimens of limonite mark this horizon to the S. W. end of the valley.

At the N. E. corner of S. 3, T. 13, R. 1, E., there is a fine exposure in a perpendicular face of the LaGrange sandstone

100 feet thick, and beneath in deep sink, of 15 feet of soft, dark, aluminous shale. Near the top of the shale is a thin stratum of very sulphurous iron ore. This being protected from the weather by the overhanging cliff, has produced by union of the sulphur and clay slate, a sulphate of alumina, or alum in an impure state; also sulphate of iron or *natural copperas*. This was the source from which the women of the surrounding region obtained material for dyeing articles of domestic manufacture in the hard times of the past.

On the opposite side of the valley in S's 13 and 23 of same Tp., was found brown ore in close connection with several thick sheets of yellowish red, hard stratified ore of low grade. And at one place in S. 13 a pit was sunk on a good show of limonite to the depth of 20 feet. At the depth of six feet the limonite had all been passed, and was replaced by a stratum of hard dark colored ferruginous material very lean in iron, three feet thick, but which gradually diminished to one foot at the bottom of the shaft. This was all inclosed in a great bed of white clay, with red streaks running through it, and having a distinctly acid taste. This is in the 5th limonite horizon and a little below the LaGrange sandstone.

At the same horizon in S. 24, T. 14, R 1, W., some large specimens of this ore were seen, south of Remlap station on the B. & H. Mineral R. R., and also in S. 23 of the same township. Here on a hill capped by LaGrange sandstone, and sloping down to the valley, is found a good show of very good limonite ore, though generally in small nodules. They are scattered along the face of the hill, apparently in two bands for a breadth of fifty to sixty yards. The lower band showed larger pieces than the upper one, and was evidently mixed with manganese. Some good specimens of manganiferous iron ore were found here, and also some good samples of pyrolusite. Unfortunately no excavation had been made on this ore, nor test pit sunk to expose its quantity or structure. From the surface indications alone, it was inferred that the deposit was sufficiently large to be of considerable value, and very favorably situated for easy min-

ing, and that manganese in some quantity and limonite were here either closely associated, or combined in the stratum. In this respect it is a very interesting locality; and it was much regretted that an exposure of the whole structure could not be obtained. Another good out crop of apparently the same ore is found in S. 34, T. 14, R. 1, W., and in S. 3, T. 15, R. 1, W. on the face of east Red Mountain. Some of it is seen near the top of the mountain where the public road crosses from Village Springs to Spradling's Cove, but it is gradually flexed downwards with the strata towards the S. W., and near the east line of section 3 its position is over 100 feet below the top of the mountain.

The ore is very good, and apparently abundant. The out crop covering a space of from 75 to 100 feet. But often out crops in the steep face of a mountain show a much greater thickness than the ore body possesses. It is probably so here. Yet if the body of ore is one-third or even one-fourth as thick as the out crops indicate, it is large enough for advantageous mining. The only uncertainty about the value of this lode is in the proportion of ore to waste matter it may carry. In this the cost of mining, and consequent value of an ore mine very greatly depend. In the absence of any excavation into this deposit, it is impossible to form any reliable opinion on this important point. When the demand for this class of ores becomes more pronounced this deposit will no doubt receive the consideration due to its apparent importance.

Many other small bodies of limonite have been observed at other points, which, from the small out crops presented, or their unfavorable surroundings, or the poor quality of ore were not considered likely to be valuable, and have not been mentioned. Two of the latter class lie about a mile from Village Springs, one north, the other north-east. The ore is very sandy, or mixed with chert--and yet this may only be the case with the upper part of the beds, which alone are seen. It is not uncommon for the upper layers of a limonite deposit to be sandy and worthless, and the lower

portion to carry good ore. Possibly this is the case in these deposits also.

Following these descriptions of the *quality*, *position*, and *location* of the limonite deposits of Murphree's Valley, we pass to a brief examination, and estimate of the *quanity* of this ore which this valley contains. This is necessary to give the reader some practical and definite idea of the magnitude, importance, and value of these ores, and the space they must fill in the futuro industrial development of the State.

Estimates of the Quantity of Limonite Ores in Murphree's Valley.

To estimate the quantity of ore in any deposit requires a knowledge of the thickness, and extent of the ore body; and of the proportion the ore bears to the waste materials which make up the bulk of the deposit. When these data are obtained, an estimate of the approximate quantity of ore in the body is a mere matter of calculation. We have not as yet the necessary data on any of the limonite deposits of the valley except on that great body of ore known as the *Champion Mines* deposit, including the adjacent Sub-Carboniferous ore.

The length of this deposit, in sight, is one and a half miles, or 2640 yards. Its breadth will average a quarter mile or 440 yards. Its depth 150 feet, or 50 yards—58,080,000 cubic yards. On an average it requires about or nearly three cubic yards of the body to yield a ton of clean washed ore. This ratio gives 19,360,000 tons of ore as the mineral contents of the lower Silurian deposit alone. To this must be added about one-fifth for the ore contained in the adjacent Sub-Carboniferous deposit, making by estimate the whole amount of ore at this place 23,232,000 tons.

The latest statistics puts the whole number of Iron Furnaces in the United States at 687, and their annual consumption of ore at 9,000,000 tons. At that rate of consumption there is enough ore at this place alone to supply all the

furnaces in the United States for more than *two years and a half;* or one of the large furnaces of the Birmingham District, running continuously, for more than three hundred years!

What amount of ore may be realized from the other limonite deposits of the valley is as yet a matter mostly of conjecture and speculation. But judging from their size, number, and their apparent capacities, it would be a conservative opinion, that in the aggregate they will yield more ore, by several million tons, than the Champion Mines deposit. This opinion may be predicated on the four larger deposits alone, without including the possible outcome of the numerous smaller ones, and hence that the capacity of this valley may be safely estimated at about 50,000,000 tons of available limonite ore.

As yet most of this superabundant raw material is unutilized. It awaits better facilities of transportation which will justify the extensive employment of capital and labor in its development. It is now probable that at no distant period the Huntsville Branch of the Mineral R. R. will be extended to make northern connections, and that the establishment of productive enterprises along its line will surely follow. With ample transportation furnished, this valley would afford facilities, and advantages for the cheap manufacture of iron, or its conversion into steel, or structural forms, unexcelled by any other portion of the State.

MANGANESE ORES.

Traces and samples of Manganese ores are found in many places. It is very widely disseminated, but the bodies, or deposits of it, are usually small. It has become of much importance in the arts, and hence always finds a ready market. It is used for the manufacture of chlorine, and bromine, and as a ready and easily available source of oxygen. It is also largely used for the improvement of steel; and for its production by the "Bessemer process," as well as several other purposes. The demand for it has more than kept pace with the supply. At present the larger portion of it used in the United States is imported from Europe. Yet even there the supply is limited. The total amount of it produced in the United States in 1882 was not quite 3,500 tons, while the importation the same year into the port of Baltimore alone, of Manganiferous ores, was 17,100 tons. It is probable that less than one-fourth of the amount used in this country is of domestic production. *The existence of deposits of Manganese ores in this region, is therefore a matter of much importance. And should the quantity prove as great as appearances indicate, and the quality prove satisfactory, it will add much value to this region.

As the ores of Manganese are not generally known, a brief description of the prominent ones will be properly presented here. There are *three* of them that are most common:

1. Black Oxide — *Pyrolusite.* — Binoxide, Dinoxide, Dioxide or Deutoxide. — One part of Manganese to two of Oxygen, or Manganese 63, Oxygen 37. It varies in color from light blue to dark grey, and to blue black or black. Hardness always less than lime spar; can be marked

*The production of Manganese in the U. S. increased to 34,000 tons in 1887, since which time it has decreased; being about 25,600 tons in 1890.
E. A. S.

with a knife; *soils the fingers;* streak black, unmetallic, fine texture, granular or massive, brittle, cleavage not perfect, breaks in any direction.

A somewhat similar ore, but combining 10 per cent. of water, is called *Manganite.* It differs mainly from the Black Oxide in being harder, having perfect cleavage and being generally fibrous or columnar in structure.

2. PSILOMELANE.—This ore has not a definite chemical composition, but usually carries from 60 to 70 per cent. of dioxide of Manganese. This ore is harder than the preceding, and varies more in color, running from light brown to black. It is often associated with *pyrolusite,* in the same bed, or even in alternate layers. It can generally be distinguished by its greater hardness, and its streak being more reddish, or brownish, and shining, or sub-metallic.

Another variety resulting from one or all of the preceding ores is called *Wad.* It is generally soft or pulverent, often light, impure, much mixed with foreign matter. It has resulted in all cases from the decomposition of the other ores. And is not theretore of any definite chemical composition. Color always brown to black, *soils fingers freely.*

All these ores are known in the markets by the rather indefinite and uncertain name of "*per-oxide of Manganese.*" That is an ore containing the largest amount of Oxide. But the market demands that they shall contain at least 60 per cent of it. Any ore which does not contain as much as 60 per cent of dioxide of Manganese is not saleable.

The 3rd common form is MANGANIFEROUS IRON ORE. It is so called because the oxide of iron predominates in it, over the oxide of Manganese. The respective oxides may vary between wide limits in different specimens; but when the dioxide of Manganese runs as low as 20, or even 30 per cent., and the oxide of iron predominates, it is called "*Manganiferous iron ore.*" Its usual color is brown, blue black, or black; and in hardness and density it approximates limonite. A good deal of ore *often called pyrolusite,* properly belongs to this class.

THE GEOLOGICAL POSITION OF THE MANGANESE ORES.

Is in the Lower Siliceous group, from 50 to 150 feet above the Black Shale. Occasionally traces of them have been seen as high up as the LaGrange Sandstone.

DETAILS OF THE OCCURRENCES OF MANGANESE ORES.

A little southwest of where the Locust Fork of the Warrior crosses the valley, and on the N. W. side of Red Mountain, begins the first prominent exposures of these ores. They were first seen near the line between Sects. 14 and 15, T. 11, R. 3 East. The formation was clearly manganiferous. It soon presented a great body of manganiferous chert rock. This is a massive rock, apparently ten to fifteen feet thick, composed of chert, and compact quartz, cemented together, and commingled with oxide of manganese. These great bowlders are spotted with blue and white, as the seams of oxide show on the surface, or commingled with tints a light blue grey color. The thickness of this ledge of manganiferous chert could not be ascertained, as the dip was nearly the same as the slant of the surface, Ten to fifteen feet of it were seen, but it may be much thicker. A gorge 18 to 20 feet deep had here been washed out, the principal exposure of this rock is along its bed. On the west side of this gorge, and extending out over the top of the slant, to the S. W. and out into level ground, is a great bed of pulverulent black oxide of manganese, about four feet thick, and covering about an acre of ground. Many pits and holes had been dug in the "curious black stuff," long before its composition was known to the diggers. From all these holes it was seen, in depth, and quality to be very uniform, and to carry throughout the mass numerous small chunks of *pyrolusite*, and *manganite*.

These chunks are generally small, seldom more than two or three pounds weight. well rounded, and smooth on the surface, lying principally in seams and layers, and indicating growth and formation, rather than decay. Near the

bottom of the deposit, the ore chunks are more numerous, and seams of the pulverulent black oxide penetrate into the underlying clay. On the east side of the gorge this deposit is not seen. If it exists there, it is wholly covered over by earth and soil. But where it is seen on the west side, it is wholly on the surface, no rock, or soil covers it. No rock, except occasional pieces of soft chert, exists in it. The question naturally arises, how could such a formation have been produced? If resulting from decomposition like wad, it would have been more mixed with impurities. Its present position gives no indication of a basin. From whatever source it came, and however formed, it was certainly once roofed in with rock and solid earthy strata. These have been removed by erosion, and probably much of the manganese also. It is scattered for several hundred yards down the slope, north, and east of the deposit. Another similar deposit, but much smaller, was once on the surface about 300 yards to the south, and 80 feet higher. This was about two feet thick, and 20 to 30 feet in diameter. A deep test shaft was sunk here to see what lay beneath. Nothing was found, except small pieces, and seams, and dendritic incrustations of manganiferous matter on the rocks. These were very marked, until the shaft had penetrated strata, which owing to the dip, lay beyond the deposit. This shaft was sunk nearly 100 feet, but it did not reach the supposed underlying manganiferous chert. A marked feature in it was, the *loose*, *seamy* and *partly decomposed rock*, encountered in *all the strata lying beneath* the manganese deposit.

Owing to long exposure much of this surface deposit is decomposed, and without washing, would not give a high enough per centage. of dioxide of manganese to be marketable. The amount of salable ore that exists here cannot therefore be estimated, but it probably exceeds the annual product of all the mines in the United States. (1882.)

South-west from this large surface deposit about quarter of a mile, surface out crops of pyrolusite ore were plainly seen, and at nearly the same geologic level. These indicated a regular stratum of ore. It had been dug into in several

places, and showed good ore at all points. Thickness of solid ore from one to two feet. This out-crop was seen for about quarter of a mile. It is a little over half way down the N. W. slope of Red Mountain. At the top of the mountain above it, (but geologically in older strata, and at least 100 feet below it,) was seen a great bed of impure manganiferous matter, consisting of chert, silica, psilomelane, manganiferous iron ore, and pyrolusite, all mixed in varying proportions. Where this was cut into a few feet, the rocks became very hard, and were in regular layers. The openings only penetrated far enough to show three feet of this material. The surface indicated much more, it covered the brow of the mountain for a breadth of sixty feet. This bed, though differing in structure, is evidently the same as seen near the line of sections 14 and 15. It is very prominently exposed here for a quarter of a mile, then a gap intervenes; beyond that for over a 100 yards, it is wholly manganiferous iron ore, soft, of a dark blue color, and probably carrying 20 per cent. dioxide of manganese. This ore if free from phosphorus will be valuable. An exposure of the Black Shale near by showed only 50 feet of intervening strata, between it and this manganiferous bed. No opening had been made on the bed, its thickness is unknown, it shows on the surface for a breadth 20 to 30 feet, but as the out crop slopes down the hill, that gives no certain evidence of its thickness. This is near the line between S. 16 and 21, T. 11, R. 3, E.

Near the east side section 21 a gap exists in the mountain, and no signs of manganese were there visible. But in the remainder of the section it comes prominently to the surface in many places. In the N. E. ¼ it presents several fine exposures of manganiferous iron ore. Also a good outcrop of the same, and of better quality, was seen in N. W. ¼. But in S. W. ¼ several openings had been made, and the best show of pyrolusite ore yet seen is exhibited. In different holes dug on it, the thickness of the bed varied from two and a half to four feet. The extent, and form of the deposit is unknown. The ore is in chunks, nearly solid in the

bed, only a little ochery clay intervening. It comes almost to the surface—one to two feet of soil and clay only above it. No rock roof to give protection, it is therefore surprising to find the ore so good, and so little decomposed. This ore is judged to carry from 60 to 75 per cent. of dioxide of manganese. It is all pyrolusite. At least no samples of any other variety were seen. This is known as the *Dabb's bed.*

The discovery of this deposit was made in a field which had long been cultivated. At length the plows interfered with the top of the bed, and revealed its existence. Its position is about three-fourths of the distance down, from the top to the base of the mountain; and slopes N. W. down towards SAND VALLEY. It cannot be more than 75 feet beneath the LaGrange Sandstone, and probably 100 feet above the great out-crop of manganiferous material, which shows so prominently on the top of Red Mountain. Diligent, and close search was made, to find an intermediate bed, or deposit, but without avail There is a strong probability of the existence of one, or more, in this space; but strata, or beds cropping outwards, on the face of a cherty slope, are in a very unfavorable position to be seen.

This deposit of manganese ore has only been slightly opened, on or near, its upper out crop. No effort has been made to trace its outline, or show its contents at a lower level. Indeed it may be said, that no really intelligent search for manganese ores, has yet been made. The fact that they do not exist in regular strata, or continuous beds, that they have not a definite geological level, has confused and perplexed prospectors. Then they show very little sign of out-crop—their decomposition products, are scarcely distinguishable from the ever present oxides of iron. The drill, and auger will have to be mainly relied on to find the deposit, and much unprofitable labor will necessarily be expended. Yet from what is already seen, it is evident that this region contains large quantities of good ore, and that much of it lies so near the surface as to be very available.

In section 28, adjoining on the south, the great body of manganiferous matter was again seen, on the top of the

mountain. Close search was made down the N. W. slope for the out cropping beds of pure ore, which experience had shown may be always expected to exist, above a large body of this material. None was found till the base of the mountain was reached. Here at the lowest exposed level, in a wash, was a bed of good pyrolusite. It was not opened, had probably not been heretofore seen. It was near, or probably at a *higher* geological level than the Dabbs bed in the section above.

The line of the out crop of the base bed of manganiferous chert, was generally seen, and traced on the top of the mountain; and also frequent samples of good ore, seen near its base, from section 28, to the Township line on the south. No openings had been made on either, in this space, yet its existence here was plainly evident.

In Section 2, T. 12, R. 2 East, was seen the first clear evidence of it in this Township. Near the top of Red Mountain, in the N. E. ¼ of this Section, the base bed or deposit stands out very prominently. It is about three feet thick, and presents the appearance of a regular stratum. In structure it is chert, cemented with pyrolusite, of light blue color. It resembles, though it is not identical with, the great bed first seen in the Township above.

No beds or deposits of ore have been found on the slope of the mountain N. W. of this, yet it certainly exists there. At the foot of the mountain in this Section, some year or two ago, a well was dug, and a thick bed, represented to be six feet, of *wad* was passed through. This was said to be thirty-five feet from the surface. Some samples were still found among the clay, and other materials taken out. It was evidently decomposed manganese. From some cause it had at this place been subjected to decomposing agencies, and was in a plastic state, and saturated with water. That this condition is only local, is very probable. It is to be regretted that enterprise has not heretofore penetrated to this deposit at some other point. When its elements become known, and it is exposed, a good deposit of manganese ore will probably be found in connection with it.

In this part of the Sand Valley the base of the LaGrange Sandstone is on the foot slope of Red mountain. The search for manganese, so far as seen near here, had been at *too high* a geologic level above the base of this Sandstone. The position of this ore is *always* in the *Lower Siliceous* between the *Black Shale*, and the *base of the LaGrange.* The lower stratum of it has never been seen within less than fifty feet of the Black Shale, nor the upper one within less than fifty feet of the LaGrange. Its range is therefore a narrow one, not exceeding 150 feet, generally less. Persistent search in this narrow belt could hardly fail of discovering valuable deposits of ore, as yet, unknown.

In Sect. 10, T. 12, R. 2 East, some good samples of pyrolusite ore were seen, and a little in the adjacent S. 16, but no body was found. In S. 30, same Tp., a little body of it may be found. The characteristic out-crop of impure manganese is seen near the top of Red Mountain; and about its base in Sand Valley, were seen a number of pieces or chunks of hardened wad. It was nearly black, rather a brown black, crumbly, soiled the hands, and had all the usual characteristics of wad. What was seen of it had mainly been torn out of the surface dirt, hence no opinion could be formed of its quantity. It was only of interest as showing the existence of manganese at that locality. In quality, what was seen was impure, and probably did not contain over 15 per cent. of dioxide of manganese.

Nearly South of this place, in S. 6, of T. 13, R. 2 E., was found a thin bed, carrying iron and manganese, yet so blended as not to be classed as a definite ore of either; color various, from purple to reddish grey, and brown; streak brown, to reddish, iron largely predominant. The bed was less than a foot thick, and though of geologic interest, of very little value. In Sections 13 and 23, T. 13, R. 1 E., some similar examples of iron ore in beds were seen, with a small mixture of manganese. One of these was cut in a pit to the depth of 30 inches, it was not known that the bottom was reached. In color it varied from dark red to light, and dark grey, and to deep brown, and black. In hardness it

was equally variable. The black was generally pulverulent like black oxide of manganese, the grey, compact but soft, the reddish brown in intervening streaks of the usual hardness of soft iron ore. This constituted the largest part of the bed. This bed is in the proper manganese horizon, between the Black Shale and the LaGrange Sandstone, and from 50 to 80 feet beneath the latter. A hundred yards to the northeast were seen blocks and pieces of chert, cemented together with blue oxide of manganese. These, as has been seen, constitute a characteristic out-crop of manganese ores. They were here seen in a hollow, and at a lower level than the ore just described. Small pieces of pyrolusite were found scattered about. The locality is one worthy of careful search.

Nearly opposite to this place, on the other side of the valley, in Sect. 16, same Tp., was seen in a deep gorge an interesting out-crop of manganiferous material in a *compact bed*, about one foot thick, of a *soft*, *brown*, *crumbly*, *brown grey color*. This too is in the manganese horizon, probably 60 to 70 feet above the Black Shale. All the rocks above this bed were colored, and stained with manganese, in varying shades from light brown to blue black. Scattered, small pieces of its ore were picked up, and afforded additional evidence of its existence here, though none of its amount or quality. This is W. N. W. from where it was seen in S. 23, and it is possible that a manganiferous belt crosses the valley also in that direction.

The next promising locality where manganese was seen, is in S. 23, T. 14, R. 1 W. It has been already referred to in the description of the brown or limonite iron ores. Good chunks of pyrolusite, from 1 to 15 pounds weight, were seen here, scattered among masses of manganiferous iron ore. It strewed the ground along near the base of the hill for a hundred yards in length, and a breadth of twenty to thirty feet. The Black Shale is not exposed, and its proximity to that is unkown. Above it, and between it and the LaGrange Sandstone, is a bed of limonite ore, and about 100 feet of Lower Siliceous strata. Unless that formation is here of

unusual thickness, the manganese cannot be over 50 feet from the shale. It is clearly in the proper manganese horizon, and probably a small expenditure of labor here would show up a good bed of the ore.

South of this, in Spradling's Cove, several samples of very good ore were seen, but owing to the faulting here, but little of the proper manganese horizon is exposed—and that too, generally covered with silt. Experience having shown that it might be hopefully looked for in a N. W. direction, search was made for it in the Sand Valley in Sects. 20, 17, &c., of T. 14, R. 1 W. This portion of the valley is much silted up, and out-crops of strata are covered. No ore was found, but at several places exposed beds of blue and purple, crumbly clays, were strongly suggestive of its existence. These colored clays had not been seen elsewhere, they are in the proper horizon, and their coloring matter seemed to be manganese.

From the foregoing description the following conclusions may be drawn:

1. That the great bulk of the manganese ores of this valley will be found in the Sand Valley, and on the N. W. side of Red Mountain. The horizon of these ores is there, more or less exposed, the whole length of the valley, while on the S. E. side of the valley this stratum is in detached and broken fragments.

2. That the out-crops of the manganese beds or deposits are mostly on the N. W. side of Red Mountain, and are hence generally concealed by the descending debris. Or they are wholly covered up beneath the floor of the valley.

3. That the discoveries of these deposits have been in the main accidental, and cover but a *very small portion* of the ground where these ores are presumed to exist. And hence, that probably much the larger portion of them remain still undiscovered.

INDUSTRIAL MATERIALS.

Among the industrial materials found in this valley, brick clay, porcelain clay, limestone, building rock, fire-proof rook, and glass sand, are the most prominent.

Brick Clay.

Clay suitable for making building brick exists in many places. On nearly all the low lying or bottom lands a stratum of fine yellow clay, several feet thick, is found just beneath the surface. Especially is this the case along all the streams that flow in from the coal measures. These streams have silted down along their course a bed of yellow clay of very fine quality. It is free from chert or gravel, or particles of iron ore, which are hard to eliminate and which are always injurious to the brick, if worked in.

There are very many beds of clay belonging to the Cambrian Limestone formation. It is generally yellow, some places in great quantity. This is the ordinary flat woods yellow clay. It is native to that formation, and is found in all of our deep Silurian valleys. In some places it affords a good brick clay, but generally contains fine gravel, pieces of chert, and much iron oxide. These cannot be got rid of, and consequently the bricks made from it are rough and not of uniform texture or strength. The iron oxide generally contains sulphur, and this with the iron results in blistering and rapid decay. Such bricks will not make a smooth, strong, or durable wall. Much of this kind of clay has been used for making brick in the vicinity of Birmingham, and used in building the city. But used only because the market did not afford a better material, at a reasonable cost. Such bricks would not be sold to intelligent builders, if brought into competition with others free from their defects, and of uniform strength and texture.

The clay found along the streams, and in the low lands of this valley, is a different material. It has been washed up from its native beds, sorted and cleaned in *nature's sluice ways*, all the coarse materials dropped out, and the clay *re-deposited in beds of uniform quality*. It always contains enough fine sand to work easily, and mould smoothly. In the quantity of sand these beds gradually vary. As they recede from the coal field the sand gradually diminishes till they reach the Sand Valley. They will be found the best in the middle, or Red Mountain Valley. These beds are found on *all the streams* that cross the valley, except the *Locust* and *Blackburn forks* of the Warrior, which have generally brought down too much sand. This clay is abundant, and of fine quality along *Whippoorwill Creek*, and the streams that form the *Calvert Fork* of the *Warrior*, and *Mill Creek*, and in the future it will doubtless be largely utilized.*

HALLOYSITE OR PHOLERITE.

Among the industrial materials which may yet be utilized in this valley, is an extensive bed of Halloysite or Porcelain Clay. It lies near the base of the Lower Siliceous formation, a little above, often close to, the Black Shale. It varies in thickness and quality and color. Generally it is about three feet thick, white or nearly white. It would doubtless in many places make a good porcelain clay. Only its out-crop has been seen, which always contains more impurities than the average of the bed. But all porcelain clay requires washing, none of it is sufficiently pure to make good white ware in its natural condition. This bed could, like similar ones, be freed from its impurities by washing, and rendered fit for this purpose. This is the same bed that has for years been worked with satisfactory results near Valley Head in DeKalb County. And the fact that it there affords material

*Since the foregoing was written, examination has been made of the fine, strong, red bricks manufactured near Rome, Ga , from the clays found along the low lands of the Oostanaula. These clays were found to be of similar origin and composition, seemingly identical, with the brick clays of Murphree's Valley. A. M. G.

of fine quality, gives hopes of yet finding it equally good, at other places where the same formation is exposed.

Whether any of this bed contains the proper proportion of silica and alumina to make fire proof brick, is not yet known. Some tests have been made, from a few places, without giving satisfaction, but these have not been sufficiently numerous to settle the question adversely.

Hone Stone.

Between the bed of halloysite clay and the Black Shale, generally close to the latter, there often exists a bed of very fine grit rock. Some of it is soft, and suitable for hone stones, or for the finest edged tools or instruments. Other portions harder and firmer, suitable for oil stones. Mechanics who have used these oil stones concur in regarding them as superior to any found in the market. Some of the stones had been accidentally found and used as whetstones and oil stones during the last forty years, but the position of the bed from whence they came was only discovered during the progress of this survey. It is mostly of a light yellow color, softer and of finer grain than novaculite. Has a finer texture and sharper grain than the Wachita oil stone. It will become better known in the future. Its position is on the western top or slope of Red Mountain—the very top member of the Lower Siliceous formation, just above the Black Shale.

Building Stone.

Among the upper members of the Clinton are two ledges of sandstone, which in many places afford excellent building rock. One is a ledge of flaggy sandstone, highly fissile, with smooth faces. It may be split into any desired thickness. And wherever it is solid enough for use, it is the most conveniently utilized building rock this region affords. Its smooth faces which are perfect planes, and its uniform thickness, make it very desirable for strong, solid work. This kind of rock is only found at a few places, this ledge being generally shaly.

The other ledge of sandstone caps the upper iron ore bed. It is a very persistent ledge, usually about ten feet thick, though in a few places fifty or upwards. This is a massive, rather fine grained sand sock. Some of it is white, though the prevailing color is yellow. Some of it is variegated by concentric rings of deeper yellow or brown. These rings are from a quarter to a half inch broad, and the same distance apart. These rocks when dressed and put up present a very beautiful appearance, and could be made very ornamental. Almost everywhere this ledge contains good building material. Some quarries have been opened at the thicker places of the ledge and the rock has been found to work well, and is highly satisfactory so far as it has been used. In quantity it is inexhaustible, and for strength and durability cannot be excelled. The pillars of the 21st street bridge in Birmingham were obtained from this rock near Oneonta.

A good sandstone for building is also found on the brow, or near the edge of *Sand Mountain.* This is the upper members of the lower conglomerate. These members are in plates or layers of varying thickness, having smooth faces and good cleavage. It is therefore easily quarried and prepared for use. Blocks of any desired length and breadth could be conveniently obtained. These upper members of this rock are free from pebbles, a uniform, rather coarse grained, stratified sandstone. Owing to its position it is not easily accessible, and therefore has not as yet been extensively used. But should there be a demand for it in the future, roads to it can be readily built, or tramways to run it down the mountain.

The *LaGrange Sandstone* also in many places will afford a good material for building. It is generally white and massive, and may be quarried out in large blocks. But it has the disadvantage of imperfect cleavage, and it is soft and crumbly, and hence does not take a good dress. It is a *freestone* of open loose structure. It is therefore very re-

fractory to the action of fire, but as yet has mainly been used for inside lining for fireplaces, for which purpose it is well adapted. Whether its refractory character is sufficient to withstand a very high degree of heat, is not yet known. But as it is mainly pure Silica, and therefore alone infusible, the inferences are in its favor.

This rock would furnish large amounts of good material for the manufacture of *glass*. And the amount of it that has decomposed into *sand* along its base, will give inexhaustible quantities of that very useful material.

The *limestones* of the *Trenton*, and the *Sub-Carboniferous* formations, are both well exposed and very abundant. They both contain a superabundance of good building material, and of a character of already well known excellence for heavy work. And some of these, especially the latter, are well adapted for the manufacture of *lime* on a large scale. And as a *flux* for the reduction of the iron ores, their close proximity makes them of very great economic importance. This ledge of Carboniferous Limestone has only been tested at *Compton Mines*, but it extends in equal volume and purity the whole length of this valley.

Fire Proof Rock.

Among the industrial materials in this valley, one of much probable importance, is a fire proof conglomerate. Its place is among the upper members of the Knox Dolomite in that debatable ground beneath the Trenton, where the Chazy belongs, wherever it exists. This rock has been seen at many places in the Silurian Valleys of Alabama, but nowhere in such abundance as in T. 13 of R. 1 E., in this valley. It is in some places nearly, or quite 100 feet thick. The lower members, where seen, were quartzite and breccia. The upper portion a more uniform and finer conglomerate. The small pebbly particles, nearly of uniform size, are generally flattened, of various colors, but mostly light yellow and white, giving the rock a light grey color. The rock is *firm*, *massive*, *strong*, but *porous* or *open jointed*. It has

enough cement to hold it firmly together, but is not filled with it, like most of the conglomerates of the Coal Measures. The rock appears to be mainly silica, with some alumina. The same materials of which fire bricks are made. In addition to this its mechanical structure renders it highly refractory. No fire test to which it has yet been subjected, affects its structure. At a white heat in a furnace, it neither melts nor decrepitates.

As these qualities of this rock have not hitherto been known, and are here only suggestively presented, it would be premature to decide definitely on its merits. They are however believed to be worthy of *immediate and thorough testing.* If this rock will fully answer the purpose for which fire bricks are now used, it will be much cheaper, and supply a want that has long been felt in this region. The rock is generally very accessible, very abundant, and having no cleavage planes, can be easily worked into any desired size or form.

A material sufficiently refractory, strong and durable for hearths, and lining of furnaces, is the only thing necessary in the manufacture of iron which this region has not hitherto supplied. Wide and persistent search among the clays has been made without satisfactory results. Perhaps among the rocks the "missing link" may be found, which will give to this region the *full complement* of necessary iron and steel making materials.

NOTE.—Years ago Mr. James Thomas informed the writer that the most satisfactory hearth for the Oxmoore Furnaces was a conglomerate rock. It has since been ascertained that *this was the rock* used there by him. It is classed by Mr. Hayes, U. S. G. Survey, as "The Birmingham Breccia."

CONOLUSION.

This description of the ores and industrial materials, so abundant in this valley, would be incomplete without a reference to its adaptation for their manufacture and utilization. *The contiguity of the raw materials*, the short transportation necessary to bring them all together are features that ought not to be omitted. It is a noticable feature throughout this valley. To this must be added, the abundance of water, both from large springs and everflowing streams. Most of these streams rise in the coal field on the S. E. side, and flow by sinuous courses across the valley. Several of these streams as they leave the valley, afford good water.power. All of them are copious enough for steam and furnace use. Each one of these streams from the coal field cuts a passage to the coal through which unlimited supplies of it may be obtained. Each of them as it leaves the valley makes a similar passage to the coal on the N. W. side. This is of special advantage, near the lower end of the valley where the supply of coal ceases on the S. E. side, the stream that there cuts through the N. W. rim opens a way into one of the best portions of the Warrior Coal Field. It is known as the Gurley Creek and Upper Warrior region. It has never yet been geologically examined by the State Survey, but is known to the writer, and therefore this statement is made advisedly.

Where the Calvert fork of the Little Warrior cuts the N. W. rim, access to the Berry Mountain coal, also of much value is easily obtained.

It will thus be readily perceived that with two lines of exposure of iron ores and one of Carboniferous limestone in this narrow valley, and ample coal accessible on both sides at its very edge, there must be economy in transportation of raw material that has not yet been elsewhere realized. Add

to this the further fact, that the streams which have cut accessible ways to the coal, have also cut the iron ore ridges and the limestone, and formed accessible ways to them. Hence the water supply is intermediate between the necessary raw materials, or may be so selected, that the ore, the flux and the fuel, may be brought together by the same track. The necessary distance that these would have to be carried would vary with location from half a mile to two miles only. Such contiguity of raw material and ample water has not been elsewhere seen; and probably does not exist anywhere else in the State of Alabama. But before any attempt to utilize these is made, careful and extensive tests of the coking qualities of the coal, and its adaptation to furnace use, should also be made. If this and the ores give satisfactory results, then evidently the manufacture of iron and steel will be more profitable here than elsewhere, by the difference in freighting the raw material.

Among the positions most favorable for furnace sites, and other industrial establishments, some have been already referred to and will not be repeated. A few others may very properly be mentioned. At *Village Springs*, near the lower end of the valley, the water supply is all that could be desired. Great fountains of the purest water gush out in many places. Large and small springs are numerous. These alone would be sufficient for the demands of manufacturing, and the use of a large population. But Village Creek, which affords good water power, also flows through the place. Down this creek a few miles is the Gurley Creek and Warrior coal basin. Iron ores of different kinds, and in great abundance, are in all the surrounding hills. The advantages of this location will not long be overlooked.

The *Blackburn Fork* of the Warrior, opening as it does an accessible route into the heart of the coal field on the S. E., also offers good mannfacturing opportunities.

Mill Creek, which opens a way into both coal fields, and whose waters cut the brown and hematite ores, the sand and limestone, and are connected with large springs of good water, offers very desirable furnace sites. So do all the

streams which unite to make the *Calvert Fork* of the Warrior. Here the limonite and hematite ores, and other necessary material, might be very economically combined.

This whole valley is also one of great agricultural capabilities. Supplies for a large population may be drawn from the soil. These capabilities will doubtless yet be taxed to their utmost to feed the multitudes that will in future years labor here in mines and manufactories.

THE END.

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GEOLOGICAL SURVEY, Special repe no. 5

—OF—

ALABAMA,

EUGENE ALLEN SMITH, Ph. D., State Geologist.

REPORT

ON THE

COAL MEASURES

OF

BLOUNT MOUNTAIN,

WITH MAP,

AND SECTIONS,

BY

A. M. GIBSON, Assistant Geologist.

MONTGOMERY, ALA.:
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1893.

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TABLE OF CONTENTS.

DR. E. A. SMITH, *State Geologist:*

SIR—In the following pages please find the results of the examination of the Blount Mountain Coal Field undertaken by your direction in the years 1891–92. The developments made show this to be a rich and valuable coal field. None of the seams have been fully explored, or tested, yet enough is now known of its contents to warrant the conclusion that this is destined to be one of the most productive Coal Fields of Alabama.

With grateful regards for past favors, this work is respectfully submitted.

A. M. GIBSON.

EAST LAKE, ALA., May 30, 1893.

REPORT.

To His Excellency,

GOVERNOR THOMAS G. JONES:

SIR:—I transmit herewith a Report upon the Coal Measures of the Blount Mountain Region, by A. M. Gibson, Assistant Geologist, who has devoted the greater part of the past two years to the examination of this region.

This report directs attention to a hitherto little known and less appreciated section of our State, and will, I feel sure, contribute materially to its future development.

I have the honor to be, Sir,

Your obedient servant,

EUGENE A. SMITH,

State Geologist.

UNIVERSITY OF ALABAMA,

July 1st, 1893.

THE BLOUNT MOUNTAIN COAL FIELD.

SECTION I.

INTRODUCTORY.

The region lying between Murphree's Valley and Bristow's Cove on its N. W. side, and Cahaba, Coosa and Wills Valleys on its S. E. side is locally known by the name of *Blount Mountain.* It has long borne this name, rather to designate than to describe it. A part of it only can properly be considered a mountain, and only a part of it lies within the present, or the former confines of Blount county.

As the county boundaries now stand, the larger portion of it is in Blount, the balance in St. Clair and Etowah counties. The portions of it that may properly be classed as mountain, are its northwestern rim adjoining Murphree's Valley, and locally known as *Straight Mountain*—and its southeastern side which is still more elevated, and makes the top of the watershed between the Coosa and the Warrior drainage. This is the part that is properly called "*Blount Mountain.*" This is a very prominent elevation, extending the whole length of this coal field, and with more or less prominence extending north-eastwards to the Tennessee River. Its height in the region under consideration is generally from 1300 to 1500 feet above sea level.

This coal area has been partially described in former publications, on "*The Warrior Coal Fields,*" and on "*The Plateau Region of Alabama.*" But these descriptions were necessarily brief and imperfect, a superficial reconnoisance only. They however showed this field to be one of importance—at least of sufficient importance to require more critical study and examination. The results of that study and examination are set forth as concisely as the subject would admit in the following pages.

An exhaustive report cannot be predicated on an untested coal field. Mining at different points, on the different seams, sufficiently extensive, can alone expose their qualities and geological characteristics. This only source of positive knowledge has been, and is yet, almost wholly wanting in this coal field. When the geological examination of this region was made no mining was being done; the seams which had been opened in former years, were abandoned, and the openings filled up, or caved in. Some of these were re-opened, but others, and probably the most important, could not be, with the limited means at the disposal of the survey. Many new openings were made, and several seams of coal exposed, the existence of which had not been previously known. All of these will be referred to in their proper places in the details, and general description of the field.

GENERAL OUTLINES AND STRUCTURE.

This coal field extends from the S. E. corner of T. 14, R. 1 west in a north-easterly direction a distance of about forty miles, to the east side of T. 10, R. 5 east. From thence it gradually merges into "*The Plateau Region*" already described by Prof. McCalley In width it varies considerably, starting in with a breadth less than three miles at the south-western end, gradually widening out on the south east side till it attains a width of eight miles. At its widest part nearly opposite the town of Springville in St. Clair county, its southeastern edge is about three or three and a half miles from the northeastern end of the *Cahaba Coal Field.* It maintains its width of seven to eight miles to the middle of T. 13 of R. 3 east at Aughtery's Gap. From thence it gradually narrows around the edge of Greasy Cove. Opposite the middle of the Cove is its narrowest portion, scarcely three miles wide. From the township line between townships 11 and 12, R. 4 east, it widens perceptibly towards the northeast till it becomes 4 to 5 miles broad, which breadth it maintains to the upper or northeast end of the field. On its northwest side its margin is nearly a uniform

straight line running nearly N. E. and S. W. It is the southeastern edge of Bristow's Cove and Murphree's Valley, to the lower, or southwestern end of the field.

Although the southeastern edge of the valley is the actual northwestern edge of the coal field, yet the high elevation called *Straight Mountain* composed wholly of coal measure rocks, intervenes between the valley and the productive portion of the field. This is a high, narrow ridge with vertical strata; its general height is 300 to 400 feet above the valley. Its breadth from 1,000 to 1,500 feet, with 500 to 1,000 feet more of very highly inclined strata along its southeastern flank, or inner side. Hence, from 1,500 to 2,000 feet in breadth, along the edge of Murphree's Valley, which although it contains much coal, because not in available position for advantageous mining, must be regarded as unproductive. Toward the upper or northeastern end of Murphree's Valley this ridge gradually diminishes in height and volume, and northeast of the Locust Fork of the Warrior River its strata are changed gradually from the vertical to a highly inclined southeastern dip.

The dip of the strata in this field is mainly to the northwest, and generally about 10° to 12°, in a few places more, in many places less, except along the southeastern side of Straight Mountain which has a variable southeast dip, of 20° to 80°. Also a strip from one-quarter of a mile to two miles wide adjoining the mountain has a gentle southeast dip gradually diminishing to the horizontal. The field has the general features of an irregular synclinal with its lowest depression of strata near its northwestern side. The southeastern rim or *Blount Mountain* being elevated higher than *Straight Mountain*, the northwestern dips extend much farther than the southeastern; and these diverse dips do not meet as in a true or symmetrical synclinal fold, but both gradually diminish until they become imperceptible, and have a space of one to two miles broad of undisturbed horizontal strata between them. This general arrangement extends through the whole length of this coal field, but is more

marked, and distinctly prominent in the wider portions. It may in descriptions hereafter be referred to as a *trough*, but it must be remembered that it is a trough with a horizontal bottom, and that bottom much nearer the northwestern than the southeastern side.

THE INTERIOR ANTICLINAL.

Through the widest portion of this field, there is a well defined *anticlinal* starting from near the southwestern end of Greasy Cove and running west by south. It is about ¼ of a mile broad; it does not make a ridge, but is plainly and distinctly seen in the low lands where the streams have eroded the strata. It is particularly noticeable where it crosses Dearmond's Creek at the old Brasher Mill site, and Sand Creek at the upper end of the old Holt place. Also where it crosses Coal Bed Branch, and Difficulty Creek, to the Blackburn Fork of the Little Warrior River in T. 14, R. 1 east. Its course was traced about 10 miles, though it probably extends much farther. Its dip on the south by east and west by north sides is 10°, but its top appears to be unbroken. Its structure strongly suggests an underlying oil basin. And this suggestion is further strengthened by the fact that near the eastern end of this anticlinal, beneath the foot of the mountain a strong odor of escaping petroleum is perceived, and the slates of the lower coal measures are impregnated with oil, and burn freely in the fire. The underlying Trenton Limestone carrying much carbonate of magnesia is the great oil and gas producing rock—the source of the oil and gas in western Ohio, and eastern Indiana. This rock is of that character in the valley to the west, where it is largely exposed—whether it is of this necessary oil producing character beneath this anticlinal can only be determined by the drill. This matter must be left for future test and study.

At present we are only calling attention to the structure of this coal field, which has its symmetry in its widest portion marred and broken by this uplift passing diagonally through it.

DRAINAGE.

While the drainage from the top of Blount Mountain flows mainly with the dip of the strata to the northwest, into the head streams, or tributaries of the *Warrior River*; yet the area is distinctly divided into a series of basins by divides, or higher lands, which cross the field in a southeasterly and northwesterly direction, and make well defined watersheds between the head waters of these tributaries. The first of these divides near the southwest end of the field, crosses it near the surveyed line between Blount and St. Clair counties. Leaving *Straight Mountain* in section 19 and running east to section 22 in T. 14, R. 1 east is an elevation of land; a low flat divide between the *Canoe Creek*, and *Warrior River* drainage. From the top of *Buck Ridge* in said section 22, the dividing line of drainage is along the ridge northeast for about one mile; thence in a general northeasterly direction with the *Blount Mountain* to S. 8, T. 13 of R. 3 east. From thence in a general northwesterly direction along a high and broad plateau is the division of drainage between this basin, and the basin of the *Locust Fork* of the Warrior. The public road from Murphree's Valley to Whitney, generally, is near the top of this divide. from *Tait's Gap* in Straight Mountain, (S. 26, T. 12, R. 2 east) back to Heathcock's, and Aughtery's Gaps in Blount Mountain, in sections 16 and 21, T. 13 of R. 3 east. From Tait's Gap in Straight Mountain, southwestward, the boundary of drainage mainly coincides with that mountain to the beginning point. Only two small short streams break through it, one at the Allgood Gap, opposite the Champion Mines, the other at the Clowdus Gap three miles farther to the southwest. These two flow into the *Calvert Fork* of the Little Warrior. With the exception of these two small branches, all the drainage of the included area is into the *Blackburn Fork* of the *Little Warrior River*. This area may hence be appropriately referred to hereafter as the *Blackburn River Basin*.

SUB-DIVISIONS.

The Locust Fork Basin, begins at its southwest end on the high plateau of land which separates it from the Blackburn River Basin, thence to Blount Mountain on the southeast; thence with the top of said mountain to Gregory's Gap on the road from Walnut Grove to Attalla, in S. 24, T. 11, R. 4 east near the township line between ranges 4 and 5 east; thence north with said range line to Bristow's Cove. From Bristow's Cove southwestward with the edge of the cove, and the edge of Murphree's Valley to the line between Blount and Etowah counties; thence south along said line one mile to the top of the ridge north of the Hayse Gap; thence southwestwards along the top of this ridge to its junction with Straight Mountain near the south line of S. 18, T. 12 of R. 3 east; thence with said mountain to *Tait's Gap* the beginning point on the Blountsville & Whitney road.

All this included area is drained by the *Locust Fork* of the Warrior River—and mav be properly called the *Locust Fork Basin.*

The upper, or northeastern end of this field, is a plateau region, drained mainly by *Line Creek,* and tributaries of Clear Creek, and other streams. It possesses a greater thickness of coal measures than the plateau region lying farther to the northeast, but not so great as the basins to the southwest. It carries several seams of coal that are identical with those in the Locust and Blackburn Rivers basins, and is hence an important portion of this coal field.

The remaining portion of the field, lying between the northwest boundary of the Locust Fork basin, and the Straight Mountain, is drained into the *Calvert Fork* of the Little Warrior River. It is a small area, but holds exposed some of the best, and most accessible coal seams in this field, and hence is of much economic importance.

AREA.

The area of this coal field is a little over one hundred and fifty square miles, exclusive of the sub-conglomerate measures, and of those that are vertical along, and near to Straight Mountain, and which for that reason may never be available or productive.

VERTICAL MEASURES OF STRAIGHT MOUNTAIN.

Much coal is shown to exist in the vertical and highly inclined measures of *Straight Mountain*, but its connection, or identity with the workable seams of this field has not been found, and it is not believed ever can be. Only the leading, prominent rocks of this vertical formation are distinguishable. Of these, the first prominent hard rock on its northwest side is the *Lower Conglomerate*, and its underlying shales and rocks of the sub-conglomerate formation lie between it and Murphree's Valley, making the northwestern slope of the mountain. The next and most prominent rock near the centre of the mountain and standing vertical is the *Second Conglomerate.* This is the most prominent and conspicuous rock of this uplift. Towering far above all its associates in this compressed mass of vertical rock and strata—bold and naked, like an artificial wall, from twenty-five to one hundred feet above its congeners, like the caruncle, or comb of a rooster's head, and hence popularly called the *Cock's Comb.* (This is the great massive rock which makes *Buck Ridge*, and part of *Bee Ridge* hereafter to be described, and farther to the northeast, makes in many places the crest of Blount Mountain.) Between this rock and the *Lower Conglomerate* (which makes the falls on all the streams cutting through Straight Mountain,) is the place for the Caskie, Howard and Peacock seams of coal; but they have not been found, except in detached fragments, and pockets in the rocks. So great has been the contortion, and pressure, brought on this uplifted section, that all soft material, shale and coal seams, have been squeezed out, and

all consecutive order obliterated, even in the intervening ledges of rock.

On the southeast side of the high vertical wall of *conglomerate rocks*, the rocks are compact, and vertical for one hundred and fifty to two hundred feet, then gradually assume a southeast dip with diminishing angles to the base of the mountain. A slight southeast dip continues for varying distances still farther to the southeast. Along the southeast side of the mountain, and especially near its base, seams of coal have been exposed, but all of irregular thickness, due evidently to greater or less compression, and also varying in strike from place to place. Some of this coal has been used in the shops, and with very satisfactory results; but all of these seams are too highly inclined to be mined to advantage; neither could any of these seams be certainly identified with those lying farther to the southeast. That they belong to that base group of productive measures lying above the *second comglomerate* is very evident, and probably near the middle of the group, and certainly *below* the *fourth conglomerate*, may be regarded as settled, but this is the closest approximation to their proper geological position as yet attained. The reason of all this will be apparent when the fact is considered that while this Straight Mountain is merely a fold of the coal measures, yet some portions of them are probably hidden by faulting, and that about 3,000 feet of strata are here compressed into a space of 700 to 1,000 feet horizontal measure, hence great compression, distortion, and displacement, necessarily resulted. These facts having been recognized, no further effort was made to develop, or study the *Straight Mountain* coals, and hence they are not included within the productive area of this coal field.

Also on the opposite, or southeastern side of this field is considerable area of lower or *sub-conglomerate coal measures*, which though they carry, at least in places, several seams of coal, yet all probably too thin to be of any practical value, and are hence not included here as productive

measures. This area embraces all the coal measures which lie between the top of the sub-carboniferous, or *Mountain Limestone* and the top of the *Lower Conglomerate.*

SECTION II.

THE LOWER, OR SUB-CONGLOMERATE COAL MEASURES.

This belt or strip of measures varies in thickness from 600 to 800 feet. It is seldom that the top and base of it can be both seen at the same part of the mountain. Except in a few places the *Mountain Limestone* is wholly beneath the floor of the valley, and where it is much elevated the lower conglomerate on top has generally suffered much abrasion, and is in many places wholly gone from the crest, and the body of the rock, covered up by soil or clay can not be seen. As a close approximation to its breadth it may be said that this strip of *sub-conglomerate coal measures* usually occupies the steepest part of the mountain, and varies from half a mile to a mile in width, nearly the whole length of this coal field.

This is the formation so carefully and extensively described by Prof. McCalley, Assistant State Geologist, in his report on "THE PLATEAU REGION OF ALABAMA." This is the formation that makes the "*Plateau Region*" in the main, though generally reinforced by a thin mantle of carboniferous strata lying above, and concealing the *lower conglomerate.* Farther to the northeast in Alabama, Georgia and Tennessee, this formation frequently carries thick seams of excellent coal, but of uncertain extent, and varying thickness. Want of uniformity in thickness, and want of continuity in extent, of the coal seams are characteristics of this formation, suggesting the possibility that they were formed in *basins* of greater or less extent, and varying volume, and hence have not the uniformity of the coal seams of a later period of the carboniferous era.

It is generally believed that the coal seams of this forma-

tion thin out towards the southwest, and are not in the Blount Mountain region of sufficient thickness to be of value. This opinion may be correct, many known facts seem to favor it, and yet it is an open question, the facts are mainly of a negative character, and are not conclusive. The same seam or seams occupying the same geological relations, that are prominent, and highly productive, in Georgia and Tennessee, have been traced from the Georgia line almost to the southwestern end of Blount Mountain. Of course this tracing was superficial and from the conditions on the face of mountain could not be continuous, for the southeast face of that steep mountain is generally a confused mass of slides, and but little of its strata can be seen in place, especially where the coal seams belong. But wherever the strata were found in place at the coal bearing horizon, and not buried by slides or talus, there the seams, or clear evidence of coal seams were found. Fossil coal plants in great numbers were seen in the rocks, almost continuously along the face of the mountain, and these were generally referable to the coal bearing horizons. This seems to be sufficient evidence of the continuity of this as a coal bearing formation. And the fact that the seams which were seen, were too thin to be worked, is not conclusive evidence, in this formation where want of uniformity is the rule, that they may not be thick in other places where they are not exposed.

Several prospect openings have in recent years been made in the face of the mountain to find coal, some of them give encouraging signs, but none of them have been driven in far enough to make a fair test. It will require the expenditure of much labor to make a satisfactory test at almost any point, and while in the present state of knowledge assurance of success cannot be given, yet neither should such efforts be discouraged.

While these *sub-conglomerate measures* must in our present state of knowledge, be classed as unproductive, yet they constitute an important member in the State's geological col-

umn, and hence require careful description. They are more prominently exposed along the southeast edge of Blount Mountain and contiguous elevations to the east and north-east than anywhere else in the State, and thus come appropriately within the bounds of this report.

These measures rest conformably on the top of the *Carboniferous* or *Mountain Limestone.* The transition, (where the junction was plainly seen,) is not abrupt, but the lime rock gradually passes into calcarneous shale, and the shale gradually shows more and more silica in its upper layers till it passes into flaggy sandstone, of dark grey color near the base, and gradually changes into light brown friable sandstone towards the top. Somewhere near the base of this member a thin seam of coal exists, its position was not found on the face of the mountain, but pieces of it were found washed out of a deep hole in Canoe Creek where it ran over the rocks of this member. As the creek in its course, had not run over any higher member of the coal series, it evidently belonged here. The thickness of this member approximates one hundred and thirty feet. It is succeeded in ascending order, by a few feet of soft shale and clay, and a seam of good coal one foot thick where seen. This is succeeded by dark slate—dark grey to black, soft and fissile, eighty feet thick, followed by flaggy sand rock for twenty or twenty-five feet.

The next member, which may be local, consists of two beds of variegated crystallized limestone or marble, the lower bed four feet thick, very hard and solid, holding many fossils, and a good deal of silica—a very beautiful strong rock on which the weather seemed to have made no impression. About 20 feet above this bed is another of similar material and color, but softer, having less silica and fewer fossils. This ledge is also solid and about 20 feet thick. The prevailing colors are a mingling of yellow and brown. The thickness of this member where seen is about 45 feet.

This is followed by what is known as the "*Shaly Cliff,*"

a very prominent and persistent ledge of hard gnarly rock, often with bluffy perpendicular face 20 to 50 feet high. This ledge is the great impediment to road making across this mountain, it only can be surmounted at a few places. The whole thickness of this member is about 100 feet.

Following this is a series of flaggy and ripple-marked sandstones, yellowish and reddish colored building stone, with belts of intervening yellow clay, somewhat irregular in volume, the whole making from 50 to 75 feet.

Above this member and near the base of the conglomerate next above it is, at least in places, a seam of coal of varying thickness, but so far as seen not exceeding one foot thick. This coal seam occupies the geological position of the *Cliff Seam*, *Etna Seam*, &c., so often referred to and described in Prof. McCalley's Report on the "PLATEAU REGION OF ALABAMA" that no doubt of its identity is intertained.

The *Lower Conglomerate* caps and complete the series of *Lower Coal Measures*. It is a rock so well and widely known that minute description of it is unnecessary. It possesses here its usual characteristics; a massive, persistent rock, varying in thickness from 50 to 100 feet, in some places, composed almost wholly of well rounded pebbles, firmly cemented together, and called *Millstone Grit*, in others the pebbles are in bands and patches, or sparsely scattered through the rock, while in other parts the pebbles are wholly wanting, and the rock is merely a coarse-grained sandstone.

The series of *Lower Coal Measures* will be presented at one view by the following:

SECTION OF LOWER OR SUB-CONGLOMERATE COAL MEASURES.

(11)	FIRST, OR LOWER CONGLOMERATE	50 to 100	feet.
(10)	COAL (*Cliff seam—Etna seam, &c.*)	1	"
(9)	*Flaggy sandstones* and clay beds,	50 to 75	"
(8)	*Shaly Cliff*,	100	"
(7)	Signs of coal seam? *shale*,	35	"

(6)	*Limy* or *Marble group,*	45	feet.
(5)	*Slate bed*—dark grey to black,	105	"
(4)	Coal—good quality,	1	"
(3)	Flaggy sandstone and soft brown-stone,	100?	"
(2)	Coal—in Canoe Creek,	?	"
(1)	Flaggy sandstone (estimated)	38	"

Mountain Limestone.

These measurements and estimates are probably too low in the aggregate; they were made at the lowest gaps, where the ascent of the mountain only was practicable. Besides this, while ascending the mountain towards the northwest, the dip of the strata, averaging about 10° in the same direction, must be considered, this would carry the base of the measures a good deal lower beneath the top of the mountain than at its base. Hence it is considered that about 200 feet must be added to the measurements and estimates of the foregoing *section*, thus bringing up the whole vertical thickness to about 800 feet. In other words that from the average top of the mountain would require a perpendicular measure of 800 feet to reach the *Mountain Limestone.*

Section III.

THE UPPER OR TRUE COAL MEASURES.

Under this head are embraced all the known productive measures in this coal field. All that lie above the *First*, or *Lower Conglomerate.* The designation of this rock as the *First Conglomerate* is preferred, because there are *four distinct conglomerates* in this field, and it is easier, and more natural to designate and refer to them by their consecutive numbers, and natural order, than by any other means. These conglomerates are the guide lines, the geological land marks in the study of a coal area. They separate each series of coal seams from all others, and enable each to be examined in detail with greater certainty. Hence, the study of the conglomerate rocks of this field is first presented.

THE SECOND CONGLOMERATE.

This is the rock so often referred to in Prof. McCalley's report on the "PLATEAU REGION OF ALABAMA" and elsewhere, as the "*Upper Conglomerate.*" It is truly designated there as the "*upper*," because it is so in fact, there being no other conglomerate above it. It is there generally the top rock of the series. But in this field it lies comparatively near the *base* of the *productive coal measures.* Probably the greatest horizontal distance between the top of the *First Conglomerate*, and the *base* of the *Second*, is 3050 feet, while the thickness of strata intervening is 336 feet. These figures are probably too high for a general average of thickness of strata, or distance between these rocks; but they were obtained at the only place found where measurements could be made with approximate accuracy; and are fairly representative for a large portion of this field.

This rock resembles the *First Conglomerate* in many respects, and general structure, yet differs from it so much in general appearance, that the one need never be mistaken for the other. Its pebbles are generally smaller, less crystalline, and less firmly cemented together, and where pebbles are wanting the rock is generally of a lighter grey color, and of more coarse quartzitic structure than the other. It is also in the region under consideration, much more massive and prominent than the First Conglomerate, often rising up very boldly above the surface with its outcrop covering a space of from a quarter to three quarters of a mile wide. That the thickness varies greatly is evident, but at no place has it been found possible to measure it, except by the space it occupies.

In the lower, or southwest end of the field, it comes near to the surface over a wide space, making all that portion drained into *Canoe Creek*, a plateau region. Its southeastern outcrop makes the ridge known as *Buck Ridge* from Fall Branch in T. 14, R. 1 E., and running thence north eastwardly through that Tp. and T. 14, R. 2 E., and T. 13, R. 3 E. It

crosses the Tp. line between T. 13 and T. 12 in S. 4 of 13 and 33 of T. 12, R. 3 E.; and in S. 34, T. 12, R. 3 E., near *Walker's Gap*, it reaches to the top of the mountain; and with the exception of two short spaces it makes the main top to S. 13, T. 12, R. 3 E., where it towers in the lofty naked masses known as "*Buzzard Rocks.*" Opposite this point it was found that the *First Conglomerate* made the lowest bench on the southeastern face of the mountain, and that the Lower Coal measures were mainly buried beneath the floor of *Greasy Cove*, and that the coal seams lying between the *First* and *Second* conglomerates have their outcrops on the southeastern face of the mountain. Opposite here is the narrowest part of this coal field, the part lying between Greasy Cove, and the headwaters of the Locust Fork of the Warrior River; the cause of it is obvious, the uplift which produced Greasy Cove encroached largely on this coal field—indeed was wholly formed out of it; leaving only a margin of two and a half miles between its rim, and the Murphree's valley fold.

From the Gilland Gap, near the "Buzzard Rocks," in S. 13, T. 12, R. 3 E., the *Second Conglomerate* continues to make the top of the mountain to Tumbling Gap in S. 6, T. 12, R. 4, E. At this gap this rock is much broken up and displaced. The heaviest boulders are on the southeastern side af the mountain, and the First conglomerate still farther down towards the foot than at the Gilland Gap. This position of these rocks continues to the northeastward to Gregory's Gap in S. 19, T. 11, R. 5 E. on the road from Walnut Grove to Attalla; there the outcrop of Second conglomerate is wholly on the southeastern side of the mountain. It is only 100 feet thick, and is separated from the First conglomerate by only 110 feet of strata, while at Lyttleton on the T. & C. R. Road, near Line Creek in Secs. 17 and 20, T. 11, R. 5 E., it is at the level of the valley, and only separated from the vertical First conglomerate by a line of fault a mere seam in the rocks. But this is abnormal; for after passing up Line Creek above "*Buck's Pocket*" it assumes its normal

position on the face of the bluffs; and at the Sheffield Gap in S. 9, T. 11 of R. 5 E., it is again found at the top of the mountain.

Crossing the coal field northwestwards to *Bristow's Cove* the *Second Conglomerate* is again found making the upper part of the bluff on the east side, and extends with the bluff toward the southwest for several miles. This rim of the cove gradually declines in height toward the lower end of the cove, and sinks beneath the surface before reaching the Locust Fork of the Warrior River, and this rock too passes beneath the surface and is not seen again till it rises up in the middle of Straight Mountain near the Tp. line between Tps. 11 and 12 of R. 3, E. From thence it continues prominent to the southwestern end of Straight Mountain, as a vertical rock.

The Third Conglomerate

Is not a prominent rock, and may not be co-extensive with the coal field. Its place is near the middle of the productive measures. It is a coarse dark-colored rock in its upper parts, and near the base a reddish conglomerate formed of good-sized, but not well-rounded pebbles, firmly cemented together with carbonate of iron. Its place can be better explained when it is reached in the description of the coal seams.

The Fourth Conglomerate

Is among the upper members of the coal measures in this field. There are but two seams of coal lying above it. It occupies but a small portion of the field, and is only found in a high flat-topped ridge lying between *Straight Mountain* and *Ponch Creek*, and the *Warrior River* below the mouth of Ponch Creek. It underlies the most of sections 17, 18 and 19 and part of 8, 9 and 3 of T. 12, R. 3 east.

The rock in the upper part is light-colored, loosely cemented, weathers badly, and is hence seldom seen on the surface; but its place is plainly shown by a profusion of

well-rounded, large-sized pebbles. Its lower part is irony, harder and better preserved. Owing to its disintegration and consequent want of face exposures, the thickness of the upper part could not be ascertained, but it is evidently thin —probably 10 to 15 feet thick. The lower or irony portion of this conglomerate is seemingly thicker. At one place its outcrop measured 40 feet, that might have been greater than the average.

For 100 feet below this conglomerate bed, the rocks are all quartzitic, many of them very granular. These, with the conglomerate above, to which they are allied, making a stratum 150 feet thick, and containing several good seams of coal, are peculiar to this section of the field, and make the top member of the Blount Mountain Coal Measures.

Whether this top series of conglomerate and quartzitic measures is the equivalent of the "*Montevallo Conglomerates*," the top series of the CAHABA COAL FIELD, or not, has not been determined, but is rendered somewhat probable by the geographical relation of the Fields, and their general similarity of structure. That one is the continuation of the other is evident. Both belong to that great strip of coal area cut off to the southeast by the great Jones Valley fold, and running a southwesterly direction; the direction in which it is known the Alabama Coal Measures mainly thicken. These Fields were originally *one*, and are now only separated by the branch valley, three miles wide, which connects the Jones Valley with the great Coosa Fold. It was, therefore, reasonable to expect a greater similarity between the strata and coals of *this Field* and the CAHABA immediately to the southeast of it, than between it and the WARRIOR FIELD farther to the northwest. This expectation has been reasonably verified in the progress of this survey.

The other prominent rocks and features of this Coal Field will be noticed under the head of "*Details*."

EXPLORATION OF THE FIELD.

In the beginning of the investigation of this Field a persistent effort was made to first develop the vertical and

highly inclined coal seams, in and near the base of Straight Mountain, and to assign them to their true position and relation to the other seams. Examination of seams was made and measurements taken in the *Cowden Gap* in section 28, in the *Waide Gap* in section 27, and in the *Clowdus Gap* in section 13, all in T. 13 of R. 1 east. Also in the *Allgood Gap* in S. 4, T. 12 of R. 2 east, with the following results: The outcrop of the *Cowden Seam* is in the S. E. of S. E. of S. 28, 515 feet southeast of the vertical rocks, average dip of strata in this space 15° southeast, height of seam above the highest of the vertical rocks, at the southeast base of Straight Mountain, 171 feet.

This seam varies in thickness from 3 feet 9 inches to 4 feet 6 inches. The coal is of low grade, impure, cokes imperfectly, gives a red ash. It shows here the following

SECTION:

Roof, yellowish-brown shale	Seen 6 feet.
COAL	30 inches.
Slate, dark, soft	4 inches.
COAL	16 inches.

Bed Rock, hard, gnarly, yellow-gray sandrock.

No other outcrop of coal was found up the branch toward the southeast from which the relation of this seam to those above or below it could be inferred.

About a mile southwest of the Cowden Gap opening, on "Dry Branch," a seam of coal was exposed which was classed as identical with the Cowden Seam, which showed the following

SECTION:

Roof, slate	
COAL, slaty	30 inches.
Shale, parting	7 inches.
COAL	15 inches.
Clay, dark	4 inches.

Bed Rock, hard sandstone.

Location in N. W. of S. W. of S. 33, T. 13, Range 1 east. This coal is of a little better quality than the seam in the Cowden Gap.

On the north side of the Blackburn Warrior in N. W. of N. W. of S. 4, T. 14, R. 1 east, another opening apparently on the same seam gave this

SECTION:

Roof, dark slate	
COAL, fair	30 inches.
Shale, parting	3 inches.
COAL, good	12 inches.
Bed Rock, sandstone.	

In the *Waide Gap* in the N. E. of S. E. of S. 27, T. 13, R. 1 east is a seam of coal which has been worked, and tested for some years past to a small extent, and known as the *Waide Seam.* This seam crops out 1,000 feet southeast of the vertical rocks of Straight Mountain. Its opening shows a slight northwest dip, which is doubtless produced by a small local wave. Coal of better quality than at the openings previously mentioned. It shows the following

SECTION:

Cap Rock, hard, curly sandstone	10 feet.
Slate, nearly black	25 feet.
COAL	2 feet 2 inches.
Slate, soft	2 inches.
COAL	1 foot 4 inches.
Under Clay, dark	4 inches.
Bed Rock, dark sand-stone.	

This coal gives a red ash, cokes reasonably well, is hard and glossy, with mainly cubical fracture. It has generally been regarded as identical with the Cowden Seam, yet as many points of difference, as of agreement with that seam,

are shown in its structure and surrounding. Its true position is not free from doubt.

In the *Clowdus Gap* in S. 13 the structure is yet more complicated. From the northwestern side of the Lower Conglomerate, measured southeastward, at right angle with the strike, to the first known vertical coal seam, the distance is 545 feet, and thence to southeastern side of vertical rocks 450 feet, making whole thickness of vertical strata 995 feet. The highly inclined strata dipping S. E. gives the following

SECTION:

(1) From southeast side of vertical rocks to first known coal seam....................................50 feet.
(2) COAL, thin and irregular.............3 to 12 inches.
(3) Slate, dark blue...........................32 feet.
(4) COAL, thin seam.......................3 to 4 inches.
(5) Slate, light blue to grey...................300 feet.
(6) COAL, good, bright, hard, cokes well......1 to 3 feet.
(7) *Slate*, gray, and hard brownish gray sandstone. 50 feet.
(8) COAL, hard, brittle, cubical, (Saw Mill seam). 22 inches.
(9) Slate, hard light blue to gray...............60 feet.

It is evident from inspection of this section, that no point of identity with similarly located sections farther to the southwest, either in coal seams or strata, can be clearly perceived. It may be that seam No. (6) is the equivalent of the Waide, or Cowden Seam; but it carries much better coal, and is crushed and distorted to such a degree that its identity could only be a matter of inference.

The bed-rock of seam No. (8) alone, of all the strata seen in this section, bears a strong resemblance to the bed-rock of the Cowden Seam. But in all other particulars the two seams are wholly dissimilar.

That a fault, or slip in the strata, of unknown extent, exists in this gap, is evident from seams above No. (6) of the last section, not bearing the same relation to it, or to each

other, on both sides of the gap. One-fourth of a mile to the northeast of the line of the last section in southeast quarter of S. 18, T. 13, R. 2 east, we find Nos. 7, 8 and 9 of that section are wholly wanting, and are replaced by the following above No. 6:

FAULT SECTION.

(6)	COAL, good, bright, hard, cokes well	1 to 3 feet.
	Shale, hard, irony	20 feet.
	COAL, soft, thin seam	4 inches.
	Shale, hard, and sand-rock thin	40 feet.
	COAL, blackband seam	2 feet 2 inches.
	Sand rock, reddish, soft, and clay to top of hill	20 feet.

Here, at least 110 feet of former section are replaced by totally different strata, that probably belong to a higher level.

The upper or Black Band seam shows the following

SECTION:

Roof hard, reddish sand-rock	6 feet.
COAL	4 inches.
Clay, parting	2 inches.
COAL	4 inches.
Black Band	4 inches.
Clay, parting	2 inches.
COAL	8 inches.
Fire Clay	

On the southwest side of the Gap (Clowdus) unconformity of strata is equally as apparent, but being more involved in the uplift of the Mountain, a fair section of it could not be obtained. The highest seam there found with a southeast dip was the Saw Mill Seam, No. 8, of the Gap Section. Its outcrop was found in a gully where there was much water, and it was so highly inclined that no satisfactory test could be made on it. Its thickness and importance are yet un-

known. Where its outcrop was first seen in the Gap, on nearly level ground, it was only 10 inches thick. A test pit was sunk 15 feet farther to the south, and in that distance it had increased to 22 inches of solid coal. But the seam being under water, and dipping downwards 8° to the southeast, no farther test could be made at that place. Should it continue to increase in thickness as indicated it will prove a valuable seam of coal.

From this point all the seams that were known, or could be found, were cut in succession across the Field, at its widest part, or toward the Arch. Walker Gap, in S. 36, T. 13, range 2 east. All the streams running into the Blackburn Fork of the Little Warrior, from both sides, were carefully searched for coal exposures, or indications, and all such found were tested. Then measurements were made across the Field from the top of the Lower Conglomerate at the eastern top of Blount Mountain, as nearly at right angles with the strike as practicable, to ascertain the thickness of strata between the respective seams, and the aggregate thickness of the coal measures.

To present the data thus obtained in a concise form, and to give greater clearness to the general description of the seams, a general section of the whole Field is given, including the upper seams, found only in the basin of the Locust Fork of the Warrior.

GENERAL SECTION OF THE SUPER-CONGLOMERATE MEASRURES.

Top of Measures—Clay, irony shale, soft sandstone....20 feet.

(28) COAL, soft, no cap rock....2 feet.

Shale, irony clay, sand-rock, some pebble....30 feet.

(27) COAL, the *Bynum Seam*....4 feet 4 inches.

The 4th conglomerate and quartzite rocks...80 feet.

(26) COAL, seam not named; good, bright outcrop....1 foot 8 inches.

Coarse sand-stone, flaggy....40 feet.

(25) COAL, *Carnes, Paine, Smith, Gaither* seam............................3 feet 8 inches.
Quartzitic, sand-stone and clay.............60 feet.
(24) COAL, *Baine seam. Phillips seam?*...3 feet 4 inches.
Flaggy sandstones, slates..................65 feet.
(23) COAL, *Fossil slate seam*............1 foot 2 inches.
Soft sandrock shales and clay, about......100 feet.
(22) COAL, *Woodward seam*......2 feet to 3 feet 3 inches.
Hard arenaceous shale, and flaggy sandrocks.............................40 to 60 feet.
(21) COAL, *Armstrong seam*.....3 feet to 3 feet 5 inches.
Thin flaggy sandrock and slates...........87 feet.
(20) COAL, Thin seam—*Guide, or fossilliferous seam*....................................1 foot.
Clay slate mainly.........................44 feet.
(19) COAL, Thin seam not named..............8 inches.
Sand rock 15 feet, flaggy rock and slates 20 feet...............................35 feet.
(18) COAL, Thin seam.
Heavy bedded sand rock 20 feet, shales and slates 60 feet.......................80 feet.
(17) COAL, Thin seam.
Heavy sand rock 10 feet, flaggy sand rock 25 feet, shaly slate 25 feet, clay slate 12 feet...............................72 feet.
(16) COAL, Thin seam, no name.
Heavy bedded sand rock 20 feet, flaggy sand rocks 80 feet, clay slate and clay 2 feet................................102 feet.
(15) COAL, Thin seam, *The Farley*...............1 foot.
Rock, hard massive, 25 feet, thin sandy slates 90 feet, clay slates 26 feet......141 feet.
(14) COAL, Double seam, separated by fossiliferous shale, The *Sally hole* seam, *Mace Murphree* seam....................1 to 2 feet.
Clay, slate and flaggy sand rock............69 feet.
(13) COAL, The *Adkins seam, Clements seam,* etc.........................4 feet 6 inches.

Flaggy sand rock........................81 feet.
(12) COAL, Thin seam—*Adkins spring seam.*
Flaggy sand rock increasing in thickness....82 feet.
(11) COAL, The *Jourdan seam*............2 feet 3 inches.
Flaggy rock, heavy bedded sand rock, slate..............................57 feet.
(10) COAL, The *Ivy hole seam.* Third Conglomerate....................1 foot 7½ inches.
Shaly and thin bedded sandstone, slates....55 feet.
(9) COAL, The *Murray seam, Washington seam, Jackson seam*............................3 feet.
Soft shales, clay slates, hard gnarly rock and dark slates.......................100 feet.
(8) COAL, Found only in deep water; supposed *Waide seam*...............3 feet 6 inches.
Dark slates; sand rock, flaggy irregular....53 feet.
(7) COAL, *Big seam—Holt seam.* Outcrop in river drilled through; has several partings; whole thickness...........12 feet 6 inches.
Thin sandrock and gray sandy slates, by aneroid measure.......................80 feet.
(6) COAL, *Sand Creek, No. 2.* Thin seam........1 foot.
Heavy hard sand rock, coarse flaggy slates..............................129 feet.
(5) COAL, Soft impure in bed of Sand Creek. *Sand Creek, No. 1* ....2 feet.
Hard compact rock, generally massive.....312 feet.
(4) COAL, *Garner, Lowe, Hullett, Aderholt, Brasher, Harris seam*....................2 feet.
Flaggy to compact sandstone 250 to 300 feet, Conglomerate, 2nd 400 to 495 feet..795 feet.
(3) COAL, *Howard seam*................3 feet 6 inches.
Prismatic shale and clay slate.............125 feet.
(2) COAL, *Caskie Seam*.................3 feet 8 inches.
Reddish colored sandstone, hard shale, and compact building stone.............336 feet.
(1) *Peacock Seam*—at outcrop.........1 foot 7½ inches.

Sand rock of various grades to top of 1st or Lower Conglomerate	56 feet.
Whole thickness of upper measures	3,415 feet.
And of lower measures (see section)	800 "
Making whole depth of this Coal Field	4,215 "

Section IV.

DESCRIPTION OF COAL SEAMS.

DETAILS.

Seam No. 1, called the *Peacock Seam* from the iridescent sheen, or luster of part of its coal, was not discovered till near the close of the work in this field. It hence was not as fully tested and traced out as could have been desired. It was first discovered by digging a small pit on the lands of John C. Martin in S. 8, T. 14, R. 2 east, and in sinking a well in the southeast corner of said section; the seam was dug through near its outcrop. It was there 19 inches thick, solid coal, of very fine quality. This was 12 feet below the outer edge of the cap rock, and was not there considered a fair test of the thickness of this seam. It is believed from all the observed indications that this seam, when fully tested, will be found to be of workable thickness, and an important seam of coal. Indications of this seam could be traced southwest for about half a mile only, from the place where it was discovered. The rocks with which it is associated gradually thin out, and were not found any further in that direction.

Toward the northeast plain evidences of it were found as far as the Wm. Walker Gap in S. 34, T. 12, R. 3 east. It may not extend the whole length of the field. Probably it will be found only in that portion where the strata between the *First and Second Conglomerates* are thickest in townships 12, 13 and 14 of ranges 2 and 3 east. Over this part of the

field the space between these two conglomerates exceeds 500 feet, while toward either end it is diminished to 100 feet or less.

The composition of this coal, as determined by Dr. J. M. Pickel of the University of Alabama, is as follows:

ANALYSIS OF COAL OF PEACOCK SEAM.

Moisture	1.49
Volatile, combustible matter	32.38
Fixed carbon	61.46
Ash	4.67
	100.00
Coke	66.13
Sulphur	1.79

The *Caskie Seam* No. 2 is apparently one of the best coal seams in this field. It was first opened by a Mr. Caskie many years ago, in the northeast corner of S. 10, T. 14, R. 2 east. An entry was driven in about 20 feet, and the coal coked and otherwise tested with very satisfactory results. This opening showed the following

SECTION:

Hard prismatic shale	20 feet.
Blue roofing slate	3 feet.
COAL, with some thin clay partings	3 feet 8 inches.
Under clay, dark, sandy	2 feet.

There is good evidence that this seam extends toward the southwest as far as the divide between the waters of the Blackburn Fork and Canoe Creek; and to the northeast as far as the examination of this field was extended, though probably not generally carrying its normal thickness.

At Maldin's Gap, in the S. W. ¼ of S. E. ¼ of S. 27, T. 12, R. 3 east, the *First and Second Conglomerates* are both plainly seen about a quarter of a mile apart. This distance,

with a dip of 10° northwest, would show the thickness of strata between them to be less than 250 feet. About the place where the Caskie Seam would be looked for there are good signs of coal. One large Chalybeate spring probably comes from this coal seam. Seemingly the coal is near the surface, but it would be an unfavorable place to prospect or dig for it. The Gap is a low one, with a cross fault running through it; much water accumulates, and many springs break out here which would be a great impediment to mining. This is the gap through which the T. A. & C. R. R. Co. have run the line of survey for the location of their road.

From this gap toward the northeast the second conglomerate makes the top the mountain mainly, and the seams lying beneath it are found on the face of the mountain. The debris and slides on the steep slope towards Greasy Cove have generally obscured the outcrop of this seam for many miles. Its position was seen and recognized at Gregory's Gap, in the southwest corner of S. 19, T. 11, R. 5 east, and also in the same section on one of the branches of Clear Creek. In this region the seam is thin, and the strata between the first and second conglomerates is reduced to 110 feet by aneroid measurement.

On Line Creek, in sections 8 and 17, T. 11, R. 5 east, this seam has again become thicker. Several openings have been made on it by Dr. Dozier and others. The works were closed up and a section could not be obtained. The reputed thickness is 30 inches solid coal. Its position was also seen here on the lands of Mr. Gordon, on the north side of the creek.

This seam was next found in S. 1, T. 11, R. 4 east, where it had been opened by G. B. Waide. The opening was made on the eastern rim of Bristow's Cove, 90 feet above the floor of the cove. The first conglomerate, not seen, its place is beneath the surface. The dip of the seam here is 60° east at the surface, but it is gradually lessened after passing the immediate rim of the cove to 10° or less in 200

yards. The opening was caved and filled up, but from Mr. Waide was obtained the following

SECTION:

Hard arenaceous sand rock	10 feet.
Blue clay, or decomposed blue slate	4 feet.
COAL, bright, glossy, nearly solid	3 feet 10 inches.
Clay, parting	4 inches.
COAL, cubical	4 inches.
Under clay.	

This coal, so far as seen, appears to be of good quality, and is reported to coke well and to work well in the blacksmith forge. It has not been as yet otherwise tested.

From the regularity of the uplift in the southeastern edge of the Cove, it is probable that this seam may be found at the proper level both above and below the Waide opening for a space of eight or ten miles. Toward the Locust Fork of the Warrior River it evidently is sunk downwards, passes beneath the river and is not seen any more on the northwestern side of this field.

The *Howard Seam* No. 3 of the general section is found at the widest part of the field 125 feet above the Caskie Seam, and just beneath the base of the great second conglomerate rock. An opening was first made on this seam by Mr. Howard on the S. E. of N. E. of S. 9, T. 14, R. 2 east. It shows the following

SECTION:

Hard massive sand-rock at face	12 feet.
Yellowish-gray shale and blue slate	10 feet.
COAL, hard, bony	1 foot.
Dark shale parting	½ inch to 2 inches.
COAL, good	2 feet 6 inches.
Fire Clay, bluish-white, very fine	2 feet.

This seam, like the former one, (No. 2,) will not probably be found farther to the southwest than the drainage of the

Blackburn Fork of the Warrior extends in that direction. From thence toward the northeast its place is easily recognized, though often deeply hidden by debris piled up over its outcrop at the base of the second conglomerate. This base rock, which forms the cap rock of this seam, is generally a coarse sand-rock, seldom carrying pebbles, but always of such coarse grain and light gray color as to be readily recognized as a member of the second conglomerate.

At Malden's Gap, in S. W. of S. E. of S. 27, T. 12, R. 3 east, it is about a quarter of a mile northeast of the top of the mountain. Between Malden's and Gilland's Gaps it is on the very top of the mountain. It had here been dug into by Mr. Bynum years ago and some coal exposed, but not fully developed. In the region around Gilland's Gap, in N. E. of S. W. of S. 13, T. 12, R. 3 east, its place is about 200 feet below (S. E. of) the top of the mountain. A bold chalybeate spring breaks out here, known as the Gilland spring. Some digging had been done here and some coal and blackband ore exposed. The rocks contain many fossil coal plants and the position of the seam here is easily determined.

At Tumbling Gap in southeast of S. 6, T. 12, R. 4 east, its place was found on the southeastern face of the mountain, about 200 feet from the top. The strata here are too much broken up to warrant the successful opening of the seam at this place, though much more favorable places can be found on either side.

In S. 19, T. 11, R. 5 east, this seam had been opened by Mr. Copeland in two places. The seam is thin here, so far as cut into, only 15 inches thick, though its maximum certainly had not been reached. The coal is of fair quality, and further development may show better results.

On the breaks of Line Creek in sections 8 and 17, T. 11, R. 4 east, the strata are much broken and contorted, yet plain evidences of this seam were observed at several places. Near the second railroad bridge, on the north side of the creek, is a mural face of rock believed to be the second con-

glomerate, 125 feet thick, beneath which there is evidently a seam of coal; coaly, or bituminous shale, 4 feet thick, is exposed here. This is believed to be the outcrop of the Howard seam. Also, in section 9, same township, near the railroad track, a seam 20 inches thick is exposed in the railroad cut, which is provisionally considered to be the same. On the southeastern edge of Bristow's Cove the evidence of this seam was observed about 60 feet above the *Caskie seam*, and beneath the coarse disintegrated conglomerate which makes the top of the bluff, or eastern rim of the cove. It has not been opened anywhere on this side of the field, but though closer to the Caskie seam than on the other side of the field, no doubt is entertained of the identity of this and the Howard seam.

Like the other seams lying between the first and second conglomerates, this seam is not found on the northwestern side of the field at any place southwest of the Locust Fork of the Warrior River.

The *Lowe*, *Hullett*, *Garner seam*, No. 4, of the *General Section*, is the first known seam above the *Second Conglomerate*. It has long been known and highly esteemed for its uniformly excellent quality of coal. It is a very persistent seam, and bears throughout an almost uniform thickness of 23 inches. The quality of its coal very closely resembles the *Black Creek* seam of the Warrior Coal Field, but it does not occupy the same geological position. In a few places it has been seen only 21 inches thick, in others 26, and more rarely 30 inches. Over most of this field this is a solid seam of coal, but toward the southwestern end it has a small clay parting near the top. Mr. D. Aderholt has had some mining done by tunneling on this seam, in the W. ½ of S. 4, T. 14, R. 2 east, and his opening gives the following

SECTION:

Flaggy reddish colored sand rock	15 feet.
Heavy shale	6 feet.
Blue slaty clay	5 feet.

COAL, hard bright cubical	9 inches.
Clay parting	1 inch.
COAL, hard lustrous	14 inches.
Fire clay bluish gray	2 feet.

In parts of this tunnel there were 27 inches of coal, but it again diminished to 23 inches.

An opening in S. 17, T. 14, R. 2 east, gave nearly the same section—coal 20 inches.

Two openings on the same seam on the east side of S. 11, T. 14, R. 1 east, gave this section:

Roof; shale	4 feet.
COAL, good	8 inches.
Shale, parting	1 inch.
COAL, good	12 inches.
Fire clay, floor.	

This seam was not opened or traced further toward the southwest, but it probably extends in that direction as far, at least, as the divide between the Blackburn Warrior, and Canoe Creek drainage.

In a northeast direction from the Aderholt mine this seam is found on the east fork of Difficulty Creek, a little above its junction with the west fork, and is known as the *Hullett Seam.* On Coal Bed branch, in S. W. ¼ of S. 34, T. 13, R. 2 east, it was long ago opened and known as the *Lowe Seam.* On the N. E. ¼ of same section, on the west prong of *Sand Creek* it is called the *Garner Seam.* And in the N. E. of S. W. of S. 26, same township, at the Old Brasher Mill seat on *Dearmon Creek*, it was exposed at the side of the creek and known as the *Brasher Seam.* It is not seen and has not been opened on the divide between the Blackburn river basin and the Locust Fork basin, but is again found in the latter on Hurricane Creek, below Buttermilk Falls, near the junction of the east and west branches of the creek in S. W. ¼ of S. 32, T. 12, R. 3 east. Its outcrop here showed 23 inches of solid coal, with surroundings similar to the sections already given. Farther to the northeast its outcrop is

on the east side of Bee Ridge, and crossing the upper branches of the Locust Fork and branches of Pole Creek, about a mile northwest of the top of the second conglomerate. It was also opened at Harris' coal bed, in N. E. of S. E. of S. 15, T. 12, R. 3 east.

COAL SEAM NO.—. On Hurricane Creek where it passes through *Bee Ridge*, in southwest of S. 32, T. 12, R. 3 east, near to the out-crop of Coal Seam No. 4, and 30 to 40 feet higher, is a Coal Seam, which is not given in the GENERAL SECTION, because it was not found elsewhere, though reported to exist also on Dearmon Creek, at a similar height above the *Brasher Seam*.

What the thickness, or importance of this seam may be, are matters of conjecture; its out-crop is beneath a heavy impending bluff which would crush it far below the normal thickness at the edge of the seam, even if it were not otherwise reduced by weathering. It shows this

SECTION.

Solid reddish cap rock, flaggy in upper part....	20 ft.
COAL, good..................................	0 ft. 6 in.
Shale parting..............................	0 ft. 2 in.
COAL, good..................................	0 ft. 6 in.
Fire clay....................................	1 ft. 6 in.
Clay Slate, with nodules of clay ironstone......	6 ft.

Over this seam there is no covering of slate, but the coal is in immediate contact with the massive cap rock. It is a little wavy, and irregular in thickness, but this probably results from the unequal pressure of the overlying bluff.

That there may be other seams existing between Coal Seams Nos. 3 and 4 is very probable. They are over one mile apart, surface measure, and separated by nearly 800 feet of vertical strata. That all this mass of measures should be destitute of coal is improbable, but as yet no evidences of any have been discovered in this space.

COAL SEAM No. 5* is also known as the *Sand Creek* Seam No. 1. It does not give promise of being a seam of much importance. It was cut on the bottom lands, and in the bed of Sand Creek in S. 27, T. 13, R. 2 east, and on the hills facing the eastern Branch of Sand Creek, coal soft and brittle, seam about 2 feet thick, not used. It was also found in southeast of northeast of S. 31, T. 12, R. 3 east, in the Locust Fork Basin. Its position is about 315 feet above the *Lowe, Garner*, Seam No. 4, of the General Section.

About 130 feet above the Sand Creek seam No. 1 is found the *Sand Creek Seam* No. 2, No. 6 of the *General Section.* It carries good coal, but is a thin, and consequently unimportant seam, cut in southeast corner of S. 21, T. 13, R. 2 east.

Eighty feet above Sand Creek Seam No. 2 is the *Holt*, or *Big Seam*, No. 7 of the *General Section.* The out-crop of this seam was found only in the bed of the Blackburn Fork, and in deep water in Dearmon Creek. It could not be tested, or exposed by digging above water level, nor could samples of its coal be obtained for analysis. Testing was done by drilling through the seam, the record of which gave the following detailed

SECTION.

Roof, clay slate	5 feet.
COAL	0 foot 4 in.
Clay Slate	1 foot 5 in.
COAL	0 foot 3 in.
Clay	1 foot 5 in.
COAL	1 foot 6½ in.
Rock parting	2 feet 0 in.
Slate and *Coal*	1 foot 3 in.
Coal and Clay	0 foot 6 in.
COAL, hard	1 foot 6½ in.

* No. 5 is called in the vicinity, the *Upper* Sand Creek seam, and No. 6 the *Lower* Sand Creek seam, but as these names give a false idea of their relative position, we have substituted the names Sand Creek Seams No. 1 and No. 2.

Clay	0 foot 6 in.
Blackband and *Coal*	1 foot 11 in.
Clay	0 foot 4 in.

Hard rock supposed to be bed rock.

Whole thickness of seam 12 feet 6 inches. Drilling done in southwest of southwest of S. 22, T. 13 of R. 2 east.

It cannot yet be known if this drilling gives an average section of this seam. The small amount of under clay here, seems not to be in proportion to the thickness of the seam. And the absence of any clay above the rock parting excludes the idea of its being a *double* seam. Then the rock parting may be local; at one opening made on the Howard seam No. 3, a very hard rock was encountered imbedded in the coal; that opening was abandoned, and another made 100 yards farther east, where no such rock existed.

Where this seam crosses Dearmon Creek in N. E. ¼ of S. 22, T. 13, R. 2 east, a better view of its surroundings was obtained; though the seam being cut by the creek in deep water nothing could be there learned of its size or structure. Large amounts of coal were washed out here by the great flood of July, 1872. Wagon loads of it were gathered up and hauled off in after years.

About 55 feet above this seam is another one cut by this creek, No. 8 of the *General Section*. It also is cut in deep water, and while the coal could be distinctly felt with a pole, yet only, the surroundings of the seam could be seen. It is overlaid by 8 to 10 feet of dark slate, and 10 feet of hard gnarly cap rock. This rock weathers out rough and scaly, giving it an appearance readily recognized. The slates and this cap rock very much resemble, if they are not identical with, the slates and cap rock, over the *Waide seam* in S. 27, T. 13, R. 1 east, heretofore mentioned. While this evidence alone is not conclusive on the question of identy of seams, yet taken in connection with the fact that no other seam in this Field has as much similarity in surroundings, gives their supposed identity a degree of probability. From the evidence obtained it seems to be a necessary inference that

the *Waide seam* on the northwest side of the Field must be the equivalent, either of this seam, or of the one next above it, the *Murray seam*, next to be described.

This seam has not its out-crops exposed farther to the northeast than the middle of S. 23, T. 13, R. 2 east; or if so, it has not been observed. This may arise from the fact that the dip of the seam. and the steep slope of the hills, are both in the same direction, and all signs of it are hidden by the descending debris. Towards the southwestern end of the Field there are two places where coal is torn up in deep holes in the river; one in S. 31, T. 13, R. 2 east; the other in S. 10, T. 14, R. 1 east, which from their location are believed to be on the southeastern out-crop of this seam.

No. 9 of the *General Section* is known as the *Murray seam*, because it was first discovered on the lands of John Murray in northeast of northwest of S. 22, T. 13, R. 2 east. It was here cut by the river, and exposed in its bed, mostly under water. Coal, bronze shade, brittle breaking up into small cubes, good quality, cokes well, a good blacksmith coal. As exposed here the seam was only 17 inches thick, in two benches, with clay parting of 4 inches near the middle. Believing that a larger seam of coal existed here than was shown in the river, and to test it, and to show its relations test pits were sunk on the seam 200 yards to the southeast and one-quarter of a mile to the southeast of the river, and also a drill hole sunk to bed rock below the seam in the river. These tests showed that there were two small subsidiary seams of coal, one 8 feet *above*, the other nearly 4 feet *below* this seam, and that all the intermediate slates were a *mass of fossil coal plants*. The coal seam was just the same in the test pits as where cut by the river. It was made evident, however, that enough carbonaceous matter existed here to make a large seam of coal, if circumstances elsewhere admitted of its being all combined into one bed. That this should be the case in some other part of the field is very probable, and gives this seam a great prospective importance. It shows at this place the following

SECTION:

Cap rock, hard, rough, compact, shaly	10 feet
Shales and clay slates	6 feet
Coal, poor	0 foot 3 inches
Slates dark, very fossiliferous	8 feet
COAL, brittle, cubical	7 inches
Clay parting	4 inches
COAL, brittle, cubical	6 inches
Clay	2 feet 0 inches
Slate, fossiliferous	1 foot 8 inches
COAL	6 inches
Under clay	4 inches
Bed rock.	

The cap rock of this seam being easily distinguished from other rocks, was traced in an east to northeast direction to where it crosses the Blountsville & Asheville road, about three-quarters of a mile northeast of Foster's Old Chapel, thence north with the slope of the hills to the river again at the lower end of P. Clements' place, in S. W. of N. W. of S. 23, T. 13, R. 2 E., very near the corner of the section; may be in the N. E. of N. E. of S. 22. The seam was found here to be much improved, and the slates above it to have but few fossils. Coal very greatly improved. The upper bench of it has long been known, and highly appreciated by the local smiths. It is classed by them as the best coal in the Field, some of large experience say it is the best coal they ever used. The lower and more important part of the seam was discovered and brought to light by the Geological Survey. It is a notable feature of this field, and also of the Cahaba, that many of the seams have clay partings; these *partings* have in many instances been mistaken for *under clay*, and the most important portion of the seams overlooked. Other instances of the same kind will be given hereafter.

This seam shows here the following

SECTION:

Slate in river bed	5½ inches
COAL, bright, glossy, good	10½ inches
Clay parting	7 inches
COAL, like upper bench	18½ inches
Under clay	2 feet
Hard slate	1 foot 8 inches
Bed rock.	

In one mile this coal has increased in thickness 16 inches. It is here in a bed 29 inches thick, exclusive of under clay and roofing slate. Ample thickness for mining, and carrying coal that would take the lead in any market.

The seam could be opened near this place on either side of the river, above water level, and with natural drainage.

Whether this seam continues to increase toward the northeast cannot now be known, as its outcrop is covered by the bottom lands of the Blackburn Warrior in that direction to the broad divide between that stream and the Locust Fork basin. That it can be found and opened in this space there is no doubt, but it will require careful search to locate it.

Northeast of the divide this seam was certainly seen at but one place in the Locust Fork basin. On a branch on the lands of John Jackson, near the northeast corner of S. 32, T. 12, R. 3 E., the peculiar cap rock of this seam was observed. Coal had here been worked out of the upper bench of this seam 14 to 18 inches thick. The clay parting, as in many other places, was doubtless considered the base of the seam. If the lower bench, which no doubt exists here as elsewhere, has thickened in proportion with the upper one, or even to the same extent, this is here a very fine seam of coal. A proportionate increase of the lower bench of coal which is reasonable to expect, would give here over 4 feet of coal.

Toward the southwestern end of the field this seam is certainly known to have been cut at but one place, near the

mouth of Armstrong's Creek in S. 31, T. 13, R. 2 East. It is there known as the *Washington bed.* Coal has been taken out here in considerable quantities in former years, though the works are now filled up.

The coal here, as in all other places on this seam, is in two benches, with a clay parting between. Coal of very fine quality about 20 inches thick. Not thick enough for mining, here, or probably anywhere else in the southwestern part of this field.

Immediately above this seam at the Washington beds is the *third conglomerate.* Generally it is an irony conglomerate holding rather large-sized pebbles, and very firmly cemented together with carbonate of iron. It may not be coextensive with the field; was only seen at, and south of, the Washington bed, and on the river bluff at this horizon, in S. 21, T. 13, R. 2 East.

No 10, of the *General Section*, is about 55 feet above the Murray Seam, and is locally known as the "*Ivy Hole*" seam, so called from the large amount of ivy growing near to the deep hole in the river where this seam was first observed.

At the place where it was first opened near the southeast corner of the N. E. of N. W. of S. 22, T. 13, R. 2 East, it was only 13½ inches thick, and so far as traced on the river bluffs to the southwest seemed about to hold its own. But to the northeast it thickens a little. In the S. E. of S. E. of S. 15, T. 13, R. 2 E., it was drilled through at the edge of the water and found to be 19½ inches thick. Should this increase continue a mile farther northeast it would become a workable seam.

From 55 to 60 feet higher up—strata, flaggy sandrock—is the Jourdan Seam, No. 11 of the *General Section.* It is called the "*Jourdan Seam*" because it was first opened on Jourdan Creek in the N. W. ¼ of S. 14, T. 13 of R. 2 East. This was a very promising outcrop of coal, capped by a heavy ledge of sand rock, and lying above water level.

Its outcrop showed the following

SECTION:

Cap rock, heavy bedded sand rocks	8 feet
Slate and shale	2 feet
COAL	7 inches
Slate parting	3 inches
COAL	1 foot 5 inches
Fire clay.	

It was expected that this would develop into a workable seam. The coal was evidently of good quality, but further development did not show any increase in the thickness of the seam; and at other openings made on it farther to the southwest the seam was thinner and less promising than on Jourdan Creek. It may be increased in volume towards the northeast, and in the divide between the Blackburn and Locust Fork basins, but in the latter it was found to be a thin seam.

Eighty feet above the Jourdan Seam is the Adkins Spring Seam No. 12 of the *General Section.* It is a thin and unimportant seam. The intervening strata generally above and below it are thin bedded, flaggy sandstone, with intercalated beds of clay slate.

Eighty feet above No. 12 is the *Adkins Seam* No. 13 of the *General Section.*

This seam was partly exposed in the bed of the Blackburn Fork of the Little Warrior. It had long been known, and its coal was highly appreciated. But all the coal taken out here for years past was out of the upper bench of the seam, which alone was known to exist. An examination made here by the Geological Survey showed that the clay beneath this coal had not the characteristics of *under clay*, but of a clay parting in a coal seam. The drill was applied and the lower and most important portion of the seam discovered. Location in N. E. of N. W. of S. 22, T. 13 South, R. 2 East.

This seam gives the following

SECTION:

Roof, clay slate.	
COAL, good	9½ inches
Clay parting	1 foot 6 inches
COAL	2 feet 2 inches
Under clay	2 feet

Whole thickness of coal nearly 3 feet.
Thickness of seam, 4 feet 5½ inches.
Dip of strata, 4° N. W.

It was readily seen that a short distance below, or south of this bed, this seam could be opened above water level, and at a right angle with the strike, so as to secure natural drainage. A most eligible and desirable position for mining. This coal is known to be an excellent shop coal—that determines its merits, because a good shop coal must necessarily be a good coking and furnace coal. It must be low in sulphur, high in fixed carbon, coking well and easily, and producing but little clinker; hence a good shop coal must necessarily be a good all-round heating, steam and furnace coal.

It is a very peculiar fact that the *Murray Seam* No. 9 and the *Adkins Seam* No. 13, lying within less than 300 feet of each other, and carrying the best coal as yet passed over in this description, have both very thick clay partings, the removal of which will probably somewhat increase the cost of mining the coal, but the coal from either seam, when put on the market, will command a price that will fully compensate for any increased cost of its production. Both seams are so situated as to afford excellent facilities for operating self draining mines above water level, and accessible to any mode of transportation.

The next 70 feet of strata above the Adkins, or Adkinson Seam No. 13, are mainly composed of thin, smooth sandstones, with occasional intervening bands of hard, sandy slates.

Above these is coal seam No. 14 of the *General Section.* It is known as the *Mace-Murphree Seam,* the *Baldwin Branch Seam* and the *"Sally Hole" Seam.*

This seam was first opened on the lands of Mace Murphree, in the N. E. of N. E. of S. 12, T. 13, R. 2 East, but more fully tested on both sides of the Blackburn Fork, and also at a deep hole in said fork, known as the "Sally Hole," all in section 15 of the same township. Also examined where it crosses Jourdan Creek, one mile farther east in section 14.

This seam is of but little value wherever it has yet been opened. It consists of a thin seam, or stratum, of coal at the top, then an immense bed of slate filled with fossil coal plants, with a small well-defined seam of coal, and under clay at the base.

There is more carbonaceous matter scattered through the great included mass of slates than would have been required to form a thick seam of coal. In this respect it resembles the Murray Seam No. 9, where that was first opened; but differs from that in having a much greater thickness of included fossiliferous slates. A clear iuea of its structure will be obtained from the following

SECTION:

Cap rock, heavy, solid	10 feet to 15 feet
Slate roof	4 feet to 6 feet
COAL	3 inches to 1 foot
Fossiliferous slate	20 feet to 30 feet
COAL	9 inches to 1 foot
Under clay	2 feet
Bed rock.	

This seam is very peculiar in the large space it occupies —upwards of 30 feet from *bed rock* to *cap rock.* No other seam, except the Murray, has been found to approximate it, anywhere, at least in this field. Its existing conditions were evidently produced by the infiltration of sedimentary matter among the coal or peat-making plants, during the ages of

their growth, which prevented their being consolidated into one body. That the same conditions, for an indefinite period of time, should have extended over the whole of this coal field, would seem to be exceedingly improbable. Hence the expectation may be reasonably indulged, that somewhere in this field, not yet discovered, the ample carbonaceous matter of this seam may be found in one large compact coal seam.

The great thickening of the Murray Seam, under like conditions, towards the northeast somewhat strengthens and confirms this expectation.

The *Farley Seam* No. 15 of the GENERAL SECTION lies about 140 feet above the big fossiliferous seam. Strata mainly thin slaty sandrock. Coal seam opened many years ago on the Farley branch. Coal good, but too thin to be mined.

There is probably another seam lying between the two last mentioned, but if so, it is also a thin one.

Between seams Nos. 14 to 20 there are about 500 feet of strata of very similar structure, mainly thin slaty sandstone, and beds of thin sandy slate, and holding many thin seams of coal. Each of these seams is capped by a harder and more compact ledge of sandstone. These ledges of cap rock very plainly mark the position of the several seams in this thin seam belt. Neither of these six seams was anywhere found to be thick enough for mining, and they are hence regarded as of but little value.

Probably the best one of this thin seam series is the upper one, No. 20 of the *General Section*. It carries throughout very good to excellent coal, and has been much sought after for blacksmiths' use. In the low grounds and along the streams in sections 16, 17, 18 and 20 of T. 13 R. 2 E. it has been obtained by stripping off the thin overlying strata. The seam here is seldom over a foot thick, often less, and overlaid by 6 to 8 feet of very fossiliferous shale. The fossils in this slate are numerous, distinct, and often of large size. They mark the horizon of the seam so well that it is

readily located by the exposed fossils. It was hence called the *Guide seam*, because it was a well known landmark, and aided in assigning other seams to their proper horizons. This seam is lost sight of in the divide between the two main basins of this field, but makes its appearance again in the Locust Fork basin. A good deal of coal has been taken from it in sections 19 and 20 of T. 12, Range 3 E. The coal is equally as good as in the Blackburn River basin, and a little thicker—12 to 14 inches thick. The overlying fossil-filled shale is replaced by about the same thickness of fossil-filled dark *fissile slate*. This is the only seam that is known to carry this kind of slate. It mines up in large square blocks, like roofing slate, and splits smoothly one way. Wherever split there is at least one beautiful impression of a fern leaf, or frond, on one or both sides of the slate.

This seam was also seen on the bottom lands of Dry Creek in S. 19, T. 11, of R. 4 E. about three miles east of Walnut Grove. Slate fissile, and full of fossilleaf-impressions. This coal seam was stripped and raised from the bed by *Warren Haynes*, occasionally, for many years. It is not worked now, but is widely known as the *Haynes bed*. This seam was only seen at these two places in the Locust Fork basin. The position of the Haynes bed is close to the elevated southeastern margin of Bristow's Cove—the continuation and representative of Straight Mountain—with the trend of the seam closing in toward that uplift.

This condition is due to the fact that above, or northeast of, the Locust Fork of the Warrior River, the trend of the Cove is *east* of northeast, and that in the course of about twelve miles, this eastward trend has cut into the Blount Mountain Coal Field about one and a half miles. Hence all of the coal seams near its northwestern side are cut by the edge of the cove at an acute angle, and end or terminate in that uplift, which makes the southeastern rim of the cove. Hence this seam cannot be found any farther toward the northeast. This opening was made on its southeastern outcrop, and at or near its most northeastern extension.

This coal was analyzed by Dr. J. M. Pickel, of the University of Alabama, with the following result:

ANALYSIS OF COAL—HAYNES SEAM.

Moisture	1.27
Volatile combustible matter	36.49
Fixed carbon	56.19
Ash	6.05
	100.00
Coke	62.24
Sulphur	3.87

Above the Guide Seam No. 20 the strata are generally clay slate and thin sandstone; in some places wholly clay slate; in others, mainly hard slate and sandstone for fifty to sixty feet, to seam 21.

The *Armstrong Seam*, No. 21, of the *General Section*, was first opened on Armstrong's Creek, in S. 17, T. 13, R. 2 E., by W. B. Armstrong, about sixty feet above seam 20. The cap-rock over this seam is very massive, but not in all places solid rock, Generally it is a rock that weathers into a rough scaly mass, giving it the appearance of compacted shale. In other places the rock is solid and smooth in its lower portion, and only scaly and scragly in its upper parts, yet always presenting a type, or idiosyncrasy of structure that could be very readily recognized, and the seam traced without difficulty. It extends throughout the upper half of the Blackburn Fork basin, and is found in the Locust Fork basin, and probably extends through the divide between them. Towards the western end of the Blackburn Fork basin, this seam either becomes small and insignificant or is divided into two seams. Near the western side of S. 20, T. 13, R. 2 E., the characteristic cap-rock of this seam is found about 40 feet above Seam No. No, 20, with a thin six inch seam of poor coal beneath it. This is at least 20 feet below

its normal position, and more than 80 feet below the Woodward Seam next above it, yet no evidence of an intervening seam was found between them, where the upper member of the Armstrong Seam properly belonged. It is probable that this seam either divides or terminates near this place. It was not traced or recognized southwest of the range line between ranges 1 and 2 east.

To the northeast of S. 20, T. 13 of R. 2 E., its position is very plainly indicated by its very prominent cap-rock, through the remainder of this basin till it passes beneath the divide between this and the Locust Fork basin. Its cap-rock is again seen in S. 20, T. 12, R. 3 E., near the Locust Fork, and finally on the edge of Dry Creek, in S. 19, T. 11, R. 4 E., at the very edge of the uplift that makes the rim of Bristow's Cove. It is here about 40 feet above the guide seam, or *Warren Haynes'* Seam last described. It may be of workable thickness here, though its outcrop showed only 18 inches of coal.

Where first opened in the N. E. ¼ of S. 17, T. 13, R. 2 E., this seam presented the following

SECTION:

Cap-rock, hard, solid, shaly on surface	15 feet.
Roof, bluish slate, and reddish shale	4 feet.
COAL	4 inches.
Slate and black band	6 inches.
COAL	7 inches.
Clay	7 inches.
Coal	8 inches.
Slate and pyrite	2 inches.
Coal	6 inches.
Under clay	———.

Whole thickness of seam here 40 inches, exclusive of roofing-slate, and under clay—ample thickness for mining, but there were too many partings, and the character of the coal was not satisfactory.

Another opening was made in this seam in the S. W. ¼ of the same section which gave better results—seam thinner at out-crop, but carrying much better coal.

This opening gave the following

SECTION:

Cap-rock solid, upper part shaly	15 feet.
Roof, light-blue slate	4 feet.
COAL, good, bright	3 inches.
Slate and blackband	6 inches.
COAL, good	6 inches.
Clay, dark-gray	7 inches.
COAL, good, clean	8 inches.
Slate	1½ inches.
COAL	2½ inches.
Under clay	— ——.

While this opening gave but 34 inches at the edge of the cap-rock, yet the seam thickened one inch per foot as far as the entrance was made. This increase in thickness gave assurance that the seam was thick enough for easy mining; dip south by east 4 deg.; above water-level, self-draining. The coal was found to be a good shop coal, coking well, and holding but little sulphur.

Its analysis by Dr. J. M. Pickel is as follows:

ANALYSIS OF COAL—ARMSTRONG SEAM.

Moisture	1.46
Volatile combustible matter	31.11
Fixed carbon	64.97
Ash	1.46
	100.00
Coke	66.43
Sulphur	3.87

This is an excellent seam of coal of the very best quality and giving an exceedingly small percentage of ash.

Above the cap-rock of the Armstrong Seam the strata are hard arenaceous shale and hard flaggy sand rocks, increasing in hardness and thickness to the bed rock of the Woodward Seam, which is a solid, compact, yellowish-gray sand rock 2 to 3 feet thick.

The whole thickness of intervening strata, between the Armstrong and Woodward seams is forty to sixty feet.

The Woodward Seam No. 22 of the *General Section* has been cut in many places in sections 18 and 19 of T. 13, R. 2 E. An opening was made on this seam in the S. W. of the N. E. of s—d S. 19 with the following results: Seam penetrated about four feet, when work was stopped by wet weather, and the caving in of the cut. The seam at the end of the cut presented the following

SECTION:

Roof, soft slate.	
COAL, cubical	9 inches
Slate parting, probably local	½ inch
COAL, good	10 inches
Clay parting	3 inches
COAL, bright, hard	16¼ inches
Under clay.	

Whole thickness of seam 39 inches; the seam thickening and the quality of the coal improving as the work progressed. A sample of the coal last taken out upon analysis by Dr. J. M. Pickel yielded the following result:

ANALYSIS OF COAL—WOODWARD SEAM.

Moisture	1.17
Volatile combustible matter	34.90
Fixed carbon	59.52
Ash	4.41
	100.00
Coke	63.93
Sulphur	2.20

This seam as observed at many other places is always in two benches. It has always a clay parting near the middle of the seam. The small slate parting in the upper bench in section 19 was not seen at any other place. It was hence inferred that it was only a local peculiarity, and would not continue far. The seam may therefore be considered as a two-bench seam, carrying 16 to 18 inches of coal each, and separated by 3 to 4 inches of clay, which is easily removed and will much facilitate the operation of mining and working this seam.

This coal has a fine reputation as a good shop coal. It cokes well and easily, is low in sulphur, and possesses a large amount of fixed carbon, giving it free combustion and endurance in the furnace.

At some places where this seam has been opened the upper bench has been found too bony for good blacksmith coal, and better suited for grate coal, yet this peculiarity is also local and does not obtain universally. Where this seam was opened by the Survey there was very little difference in the grade or quality of the coal in the two benches of the seam, the upper one being just a little more splintery, and mining out in larger blocks than the lower one was the only observable difference.

This is doubtless a fine seam of coal, thick enough for mining, and occupying a position in the field high above water level, and lying throughout its extent almost horizontal, will give all desirable facilities for easy mining.

The Woodward Seam is the upper one over a large extent of this field. It may be regarded as the top seam of the Blackburn River basin, so far as it extends. It is found on all the high lands to the north and northwest of the Blackburn Fork. It may extend through the divide between the two basins, but has not been seen or recognized in the Locust Fork basin. It probably exists there also, but is thinner and less prominent than in the Blackburn River basin.

Above the Woodward Seam the strata are mainly fine ar-

gillaceous shale of varying thickness, according to the elevation of the country, from 40 to 125 feet.

These strata are easily eroded and have been much gullied and excavated, and now present a surface of level plateau flanked by steep-sided ravines and gorges, and long, dry hollows and low ridges.

Near the divide between the two basins there has been less erosion, and the country is in the main an undulating plain, only broken by the small streams which make the headwaters of the two forks of the Warrior River. On this high plateau there is no well marked top of the water shed, but streams are found interlocked and flowing in opposite or diverse directions into the Calvert Fork, the Blackburn Fork and the Locust Fork of the Warrior River.

On the northwestern side of the Field, near the top of the divide in S. 26, T. 12, R. 2 East, near the Tait Gap, in Straight Mountain, the surface becomes more elevated towards the northeast, and a higher series of coal measures exists. These upper measures increase in thickness and elevation for two miles in a northeasterly direction, attaining their maximum elevation in sections 17 and 19 of T. 12, R. 3 E., but continuing to, and across, the Locust Fork of the Warrior River.

In this space it must also be noticed that the measures decline or sink towards the basin of the Locust Fork, and hence the upper measures have a greater thickness here than is apparent from the elevation of the country. It has not been found practicable to get an accurate measurement of the amount of this declination of the measures towards the Locust Fork. Yet it is very perceptible on both sides of the river. The depression appears to centre, or be the greatest, at, or near, where the river passes out of this Coal Field. This roll or depression may not much exceed a hundred feet. It cannot be less than that and certainly cannot exceed two hundred feet.

But it is enough to put the lowest seam of the upper measures below water level at its southeastern outcrop, its

highest point. *Water level*, however, is always a relative term, dependent on the natural drainage of the locality. Yet the base of these upper measures here is so near the level of the river that it is apparent that they are absolutely lower by from one to two hundred feet than they were a few miles to the southwest.

The lowest seam of this upper series of measures is No. 24 of the *General Section*, a very fine seam of excellent coal. It was opened near its southeastern outcrop, on the head-waters of Pouch Creek, by Mr. Phillips, and is known as the *Phillips Coal Bed*. The opening is in S. 19, T. 12, R. 3 East, about 50 yards east of the range line, and within a 100 yards of the southwest corner of the section.

The coal was reached by stripping off the surface clays, three to six feet thick. No cap.rock or roofing slates above the coal at this point. Coal of good quality, in one solid bed, 3 feet 2 inches thick. The works were filled up when examined and a section of the bed could not be obtained. The dip of this seam at this place is 10° to southwest, this is doubtless due to some local roll in the measures. A quarter of a mile to the northwest, where the rocks are well exposed, the dip is very regular, about 8° to northwest.

This seam of coal could be drained and mined at this place, and when cut into beneath a solid roof would doubtless yield a still better quality of coal, with a probably increased thickness of seam. A short distance from the opening the edge of the cap-rock of this seam crops out, but its thickness could not be ascertained.

The rocks above and around this seam are all quartzitic, composed of distinct and well rounded grains of quartz. All of them show the saccharine or sugar-loaf texture; while some have the fish-roe, or öölitic texture. This peculiar lithological structure extends from a little below this seam, with slight variations to the very top of the measures. Hence this upper group of coal seams may be properly designated as the quartzitic, or upper conglomerate group.

This is a very interesting and valuable group of coal

seams. It does not cover a large extent of country, but holds throughout its extent *three* very fine seams of coal, besides several smaller ones in a vertical thickness of one hundred and eighty-five feet.

The only other opening beside the Phillips yet made on the lower seam of this group, is about a mile north of the Phillips bed, and on the opposite side of a high ridge in the S. E. of N. E. of S. 18, T. 12, R. 3 E. This opening was made many years ago, and coal taken out from time to time by many different parties. The opening is locally known as the *Lower Baine bed.* The opening was made by sinking a pit in a flat hollow, near the side of a branch, and below water level.

Many statements, probably exaggerated, were made about the thickness of this seam by the parties who had dug coal here. They generally agreed that "the seam was over 6 feet thick." Others said "the seam was standing on edge, and was more than 6 feet across." These statements were made by men of average intelligence and unquestioned veracity.

To settle the uncertainties about the size, structure and identity of this seam, it was determined to clear the pit of water if possible, so that the seam could be seen and examined. With the aid of several hands, and after long and persistent labor, this was accomplished.

The seam was found to occupy a normal position—dip 6 deg. east, and gave about the following

SECTION:

Blue shaly clay and thin coal seams........2 feet
COAL, solid, face and butt structure.........3 feet 4 inches
Clay, apparently under clay.

It is not absolutely certain that the clay beneath this coal is *under clay*; it may be a clay parting in the seam. The inflow of water was too great to admit of testing any deeper. It can only be positively stated that it had the appearance of *under clay*.

This coal is of very fine quality, and the seam is evidently one of great value. Though the seam where opened is below the water level, except in very dry weather, yet there is fall enough that could be used, without heavy expense, to make a large portion of this seam self-draining.

An average sample of this coal analyzed by Dr. J. M. Pickel gave the following results:

ANALYSIS OF COAL—BAINE BED.

Moisture	1.18
Volatile combustible matter	32.35
Fixed carbon	64.18
Ash	2.29
	100.00
Coke	66.47
Sulphur	0.92

This is a very remarkable seam of coal—practically it carries no sulphur. It will be largely utilized in the future for smelting iron and furnace work. That this opening and that of the Phillips bed are both on the same seam was very satisfactorily settled by their relative dips, their equal distance above the slate beds, and their environment by the same peculiar class of rocks. All these points of agreement left no room to doubt their identity. The Baine opening shows two inches more coal, and of better quality than the Phillips bed, but these differences probably arise from its better protection; and at neither place is the seam well enough protected to have preserved its full normal thickness, or its best coal.

This seam, lying as it does at the base of the quartzitic group, is necessarily more extensive than those above it. And though it has not been opened at any other place, yet this is probably due altogether to the fact that its position has not heretofore been recognized, and the seam searched for. Lying as it does near the base of the ridges, with its

out-crop often hidden by the debris of the higher lands, it is no wonder that it has been overlooked, especially since it was in a position where no seam of coal was expected to be found or known to exist.

It may be confidently looked for above the slates and near the base of the quartzites, on both sides of the high ridge which rises between the head waters of Ponch Creek and the Drury Bynum Creek in S. 19, T. 12, R. 3 E., and extending to the Locust Fork of the Warrior, and also for a mile or more northeast of that stream.

Its position may also be approximately found from its relation to the well known *Carnes*, *Paine* and *Smith* seam, which lies about 60 feet above it, and is well marked by a heavy, massive cap-rock that generally shows its position.

The *Carnes*, *Smith*, *Paine* seam, No. 25 of the GENERAL SECTION.

This seam is better known than any other in this coal field. It is the only one on which coal mining to supply the market has successfully been carried on. A tunnel was driven in on this seam in S. E. of S. 8, T. 12, R. 3 E. by G. B. Carnes, who supplied the local demand for coal for several years. Since then other openings have been made on the seam by *Smith*, *Gaither*, *Paine* and others. The coal is uniformly good, coking well and working well in the forge. We have no analysis of the coal of this seam, but in all practical tests to which it has been subjected it has given satisfaction.

The best exposure of this seam that was examined is in the S. W. of N. E. of S. 18, T. 12, R. 3 E. It there presented about the following

SECTION:

Shale and thin soft sandstones..........	10 feet
Cap rock hard, quartzitic, wavy........	3 to 8 feet
Blue slate roof........................	3 to 4 feet
COAL, hard, bright, cubical.............	3 feet 8 inches
Under clay, fine, dark..................	3 feet

Dip of strata, 25 degrees to southeast.

This high dip evidently does not continue far in that direction. In the S. E. of N. E. of same section, about one-fourth of a mile east from this opening, and at several other places the southeast dip is 3 degrees to 5 degrees. It probably diminishes to about that declination within a hundred yards to the southeast of this opening.

In the southwest ¼ of section 8, same township, an opening was made on this seam by Mr. Samuel Smith, but a tunnel was not driven in on the seam. This opening exposed the following

SECTION:

Cap rock, coarse-grained sand rock................	15 feet
Roof, reddish clay slate..........................	8 feet
COAL, good, nearly..............................	4 feet

Under clay.

Dip southeast, 3 degrees.

CARNES' COAL MINE.

Half a mile farther to the east in southeast ¼ of the same section, is the *Carnes* opening and tunnel, on the same seam. *Coal*, 3 feet 8 inches, solid, good quality. Cap rock and roof similar to the above section. By aneroid measure the Carnes mine is 75 feet higher than the Smith opening, but the dip of the strata is here 5 deg. west, showing a local elevation or roll in the strata. The direction of the dip will fully account for the difference in elevation, while the similarity of the coal and all the enclosing strata fully proved the identity of the coal seams at the two places.

THE GAITHER OPENING.

An opening on this seam has been made by *Mr. Gaither* in the northeast corner of S. 10, T. 12, R. 3 East. Coal covered up when visited said to be 4 feet thick. A wide opening had been made here, and the bluff cut into the solid rock, but no tunneling done. The coal is said to be of very good quality, but when visited could not be seen, being buried by

slides from the top of the cut. Dip of strata here 5 deg. to northwest.

About half a mile to the northwest of the Gaither opening, and on the northwest side of the same ridge, Mr. Gaither had cut a coal seam 3 feet thick which lies 20 feet lower by aneroid measure.

It was supposed that both openings were upon the same seam of coal. There is much room to doubt the correctness of this supposition; the dip of 5 degrees would, in half a mile, carry the seam first opened, much more than 20 feet below its level at the opening in section ten (10), and the associated rocks at the second opening do not add anything to sustain the claim of identity. It is probable that the second opening here on the N. W. ¼ of S. E. ¼ of S. 4, T. 12, R. 3 East is on a coal seam not yet named or identified which lies between this seam and the Bynum Seam, and which is numbered 26 in the General Section.

The *Carnes-Gaither* Seam No. 25 has also been opened and mined by *James Smith* on the bluff of the Locust Fork, near the southeast corner of S. 2 in T. 12, R. 3 E. The coal has a fine reputation, and there is a ready home market for all that has yet been mined here. When visited, mining had been for some time suspended and the drifts so blocked up that measurements of the seam could not be made. The seam is well known to carry good coal throughout, to be solid, and upwards of three feet thick.

By aneroid measurement it was found that the seam here is 70 feet lower than at the Gaither opening in the northeast corner of section 10, showing the downward flexure of the measures towards the Locust Fork of the Warrior, heretofore noticed.

Northwest from the James Smith mine on the opposite, or northwestern side of the same ridge, this seam was also opened on the lands of *Mr. Zach. Paine*, near the line between sections 2 and 3 of the same township. Coal same as at the other openings. Seam between three and four feet thick.

This seam has also been cut by James Smith on the hills or river bluff, northeast of the Locust Fork, but the prospect was not so good as on the southwest side of the river. Probably the seam becomes thinner northeast of the river. The hill or high ridge which contains this seam does not extend far in that direction. One mile northeast of the river it becomes broken up into knobs, and these soon become less and less prominent, until they sink into an undulating plateau, which does not contain any of the coal seams of the quartzitic group.

The downward flexure of the coal measures, in this basin, has its greatest depression at, or near, the Locust Fork of the Warrior, in a southeast and northwest direction; and northeast of the river the measures are gradually elevated till they attain their normal level. The lower coal seams of this group must necessarily come to the surface within one or two miles northeast of the river. The measures here contain much less rock and hard strata than exists southwest of the river, and are more abraded. The outcroppings of the seams have not been discovered; there are no rocky ledges to designate their positions, and it is very probable that they very materially thin out towards the northeastern end.

Number 26 of the *General Section* is a seam that as yet has received no distinctive name, and about which but little is known.

It lies immediate between the *Upper Baine, Carnes Seam* No. 25, and the *Bynum Seam* No. 27 of the General Section.

Some prospector first cut this seam in a pit on the north side of the long high ridge which holds the quartzitic group of coal seams, in the S. E. of N. E. of S. 18, T. 12, R. 3 E. Its position is about 40 feet above the *Upper Baine, Carnes* seam, and probably about the same distance below the *Bynum Seam.* The pit was not cut far enough into the hill to reach or expose any cap rock, or probably to show the full thickness of the seam.

The roof was shale. The seam had increased from 8

inches at the outcrop to 20 inches at the end of the pit, a distance of say 6 feet, or about 2 inches to the foot. The coal appeared to be of good quality, and may yet prove thick enough to be valuable. The outcrop of this seam was noticed in many places along the face of the ridge, but is not known to have been cut at any other place, unless the opening made by *Mr. G. F. Gaither* in section 4 of this township, heretofore alluded to, is on this seam. That it is, seems very probable.

Its position and surroundings correspond better with this seam than any other. The difference in the thickness of the seam at the two openings, one 20 the other 36 inches, may be altogether due to the depth to which the respective openings have been cut into the seam.

Neither of them had penetrated far enough into the hill to make a fair and satisfactory test—the capping rock and roofing slates were not reached—only enough exposure was made to render it reasonably certain that this is an important and valuable seam of coal.

THE *Bynum Seam* No. 27 OF THE *General Section.*

This coal seam was opened by Elijah Bynum, near the middle of S. 17, T. 12, R. 3 E., on the southeast side of the quartzitic ridge. This seam is about 180 feet above the *Phillips* or *Lower Baine* Seam, and just above the fourth conglomerate rock, some of the pebbles of this rock are found in connection with the seam. It has as yet been only partially opened, and accurate measurements could not be made, but it shows approximately the following

SECTION:

Shale and soft sand rock..................	20 feet
Roof, blue slate..........................	4 feet
COAL, very good...........................	4 feet 4 inches
Under clay................................	3 feet
Soft sand rock and conglomerate...........	30 feet

When examined, the opening or pit was partly filled up. and only the upper part of the coal seam was visible. It was described by the man who opened it, as having a 2-inch slate parting near the bottom; approximately the seam carries about the following

SECTION:

Coal, solid, good	36 inches
Slate parting	2 inches
Coal, solid, good	14 inches

Thickness of coal at outcrop, 50 inches.

There is good reason to anticipate an increase in the thickness of this seam when cut in beneath a solid roof. It would require a further cutting of ten feet at this place to get under a solid cap rock, Until that is done, a fair exposure of the size of the seam, or of the quality of the coal it carries, cannot be obtained.

This coal has been freely tested in blacksmith forges, and is commended as a good shop coal. The seam is evidently one of the best in this coal field; probably carrying a thicker body of solid coal than any other yet discovered.

But unfortunately this seam is of but very limited extent. So far as yet known it only underlies portions of sections 17, 18 and 19 of T. 12, R. 3 East. Possibly a little of this seam may exist in section 9 of this township, though its outcrop was not seen there, and this opinion is based solely on the fact that a portion of that section is apparently high enough to contain it.

The space which this seam is certainly known to underlie is about 700 acres. But small as this area is, should the seam only hold the thickness it shows at the outcrop, it contains over 5,000,000 tons of coal.

The strata in the ridge containing this seam are nearly horizontal. This ridge stands just where the northwest dips of Blount Mountain meet the southeast dips from Straight Mountain, both gradually declining into the horizontal

Coal mining could be cheaply done here. Self draining tunnels could be driven into this seam on either side of the ridge, at any desired point, thus avoiding the usual heavy expense of pumping water and hoisting coal.

The outcrop of this seam was traced from the Bynum opening in section 17 toward the southwest. It shows very plainly in places around the irregularities of the ridge to the southeast ¼ of section 18, where is found the southwestern outcropping of the *fourth conglomerate*. About 10 feet above this rock and little farther to the northeast is the outcrop of the Bynum Coal Seam, its farthest southwestern margin. From this point toward the northeast the ridge rises about 50 feet higher than the outcrop of this seam for a half mile, thence for the like distance is a further rise 25 to 50 feet. On the northwest side of this ridge the outcrop of this seam is generally very plainly discernable, just above the upper edge of the decomposed conglomerate. It is not marked by any bold outcropping cap rock, as most coal seams are marked. The cap rock of this is evidently soft friable coarse sandrock, which only occasionally shows on the surface at all, and never prominently.

Towards the northeast corner of section 17 the ridge becomes very narrow, and it is cut by a gap in the southwestern ¼ of section 9, called the Hayse Gap, in which the strata is abraded down below the fourth conglomerate. No evidence of this seam was found any farther to the northeast, though in portions of this section (No. 9) the ridge again rises higher and the large pebbles of the fourth conglomerate are often seen in abundance, and not always on the highest ground. Some parts of the northeast ¼ of this section and of the northwest of section 10, and of the southwest of section 3 of T. 12, R. 3 E., are seemingly high enough to contain remaining detached portions of this seam. When searched for, the horizon of the underlying conglomerate pebbles will be the best guide the prospector can follow in seeking its location.

No. 28 of the *General Section*, the top seam of this coal field, has no distinctive name. Its position is about 30 feet above the *Bynum* Seam, or 35 feet above the top of the *fourth conglomerate*. It has only been dug into in one place, where it was two feet thick. This may not be average thickness for the seam, Its outcrop was seen in several places, and its position satisfactorily obtained. It does not appear to be well roofed in, and the coal is probably soft, neither does it occupy quite as much space as the Bynum Seam No. 27.

The measures above the Bynum Seam are mainly composed of irony shale and soft reddish clays, with very little rock appearing on the surface. Yet there may be in places a sufficient roof of rock, or hard slate, to give this seam the necessary protection against the disintegrating agencies of nature, and make it of some commercial value.

Above Coal Seam No. 28 there are rarely more than 20 or 30 feet of strata. The ridge which makes the top member of the measures in this field is smooth-topped, with surface gently undulating. It rises gently near the divide between the headwaters of the Blackburn and Locust Forks, and close to *Straight Mountain*, forming on its southwestern end apparently a part of that elevation, but gradually separating from it towards the northeast. Between this ridge and Straight Mountain rise the extreme headwaters of the *Calvert Fork* of the Little Warrior. This stream flows northeast between this ridge and Straight Mountain to about the middle of S. 8, T. 12, R. 3 E., where it has cut through the latter, and pursues its southwest by west course down Murphree's Valley.

This ridge begins to rise higher towards the northeast, near the Range line between Range 2 and 3 East, and its rocks begin to show a distinctly quartzitic structure. It probably attains its greatest elevation in S. 17, T. 12, R. 3 E., but there is no material diminution of its height to the Hayse Gap heretofore mentioned, in section 9 of this township. It is again nearly cut through in section 3, same

township, by the head stream of Whipporwill Creek, which rises near its southeastern side. Approaching the Locust Fork, its altitude is sensibly diminished by the declination of the strata in that direction; and that stream divides it near its northeastern end.

This ridge which is so prominent and important on account of the valuable coal seams it contains, is comparatively narrow, only about a mile in diameter at the base, and often less than half a mile broad at the top. It stands close to Straight Mountain for about half its length, there being a space of only from 100 to 300 yards between them, but they gradually separate and become farther apart toward its northeastern end, where they are nearly a mile apart. In other words, the northeastern end of this ridge is about one mile southeast of the vertical southeastern edge of Bristow's Cove; but there is a small vertical uplift *between them*, and within one-fourth of a mile of the base of this ridge. This vertical uplift is probably, as heretofore noticed, a branch, or fork, of the Straight Mountain uplift, which deflecting eastwards, is plainly seen extending as far as the northeastern end of this ridge, but beyond that is not perceptible on the surface.

The foregoing embraces all the observed facts and details of coal seams in this field, which may be regarded as reliable, or reasonably certain. There are other seams of coal the identity of which have not been conclusively settled, and matters of fact and observation which may be stated only hypothetically. All these are reserved for the next section.

SECTION V.

UNSETTLED QUESTIONS.

While much time and labor and study have been given to this field with a view of identifying every coal seam, and

clearly outlining its structure, yet owing to certain irregularities of level and of faulting, this has not in all cases been clearly accomplished.

The greatest difficulty in identifying seams was found along the southeastern base of Straight Mountain, where a fault of varying and uncertain depth exists. This fault partly exposes, but also dissevers the mountain from, the northwestern edge of the productive coal measures. Several important coal seams are found in close connection with this line of fault which as yet can be only doubtfully referred to their proper position in the field.

Among these doubtful seams is the *Waide seam* already described under the head of "*Explorations*" (page 23). It was doubtfully referred to No. 8 of the *General Section* under the head of *Details*. That reference was made solely on the similarity of the surroundings, the cap-rock and intervening slates, the coal seam being under deep water, and unseen. Could the coal seam have been examined at this, or other places in the river where it was presumed to come near the surface, and to be cut by the water in deep places, fuller evidence of identity would probably have been obtained. Usually the surroundings of a coal seam, the overlying slates and cap-rock, afford better evidence of identity than the size and structure of the coal seam itself. The latter may vary from place to place in quality, thickness and partings, all produced from local inflows of sediment during the period of its formation; the former resulting from a general inflow of sedimentary covering, more widespread, uniform and persistent, necessarily give characteristics of greater uniformity. From these surroundings alone, and from the further fact that no other seam of coal possessed similar surroundings in that part of the field where its outcrop must necessarily come to the surface, this one was without much doubt referred to the *Waide seam* No. 8. This would, if accepted as sufficient evidence, fix its southeastern outcrop in nearly a southeast course from the Waide Gap where it

was discovered, but does not serve to fix its position except inferentially in other parts of the field. In fact it is not yet certainly known that this seam has been seen at any other point than the Waide Gap. Yet it is very probable that at its proper horizon it is co-extensive with this coal field.

A coal seam of about 3 feet thickness exists at the *Allgood Gap*, in S. 4, T. 13, R. 2 E., in connection with a large body of slates, which may possibly be this seam. But it is among the vertical measures, with no cap-rock or other surroundings to afford it identification. Should this be the *Waide seam* it is evident that its normal place is far beneath the surface, and can only be reached by deep mining. In the other gaps through Straight Mountain, between this one and the Locust Fork, its position is still deeper, and it is not brought to the surface by the vertical uplift. Its southeastern out-crop in the middle of the field is necessarily in the high lands which make the divide between the two branches of the Warrior, where all out-crops are so thoroughly covered up that no coal has yet been discovered.

The Cowden Seam—not classed and probably not included in the *General Section*—presents another case of unsettled identity. This seam, of which a description and sections are given under the heading of "*Explorations*," was one of the first coal seams opened in this field. It was opened the first year of Prof. M. TUOMEY's service as *State Geologist of Alabama*, under the direction of *George Powel* one of his assistants. The opening on it was made by John P. Cowden, who had discovered it, and is hence called "*the Cowden Seam.*"

The assistant reported the seam as being 4 feet 10 inches thick, and Prof. Tuomey paid Mr. Cowden a premium of $10.00 for its discovery.

The first opening on this seam may have been made where it was abnormally thick; subsequent openings near the same place show a seam of 4 feet 2 inches thick, including a parting of 4 inches of soft slate, dividing the coal into two

benches; about two-thirds of it above the parting, and one-third below.

Other openings made presumably on the same seam, in gaps through Straight Mountain, yet farther to the southwest, show a still thicker parting with slightly less coal.

The character of this coal where first opened is peculiar. It is massive, rather dull in color, cokes imperfectly, and yields a rather copious red ash. Farther to the southwest the quality of the coal is somewhat improved, but yet it retains all of its distinctive features.

The unsettled questions about this seam are, what is its true position in this field, and what relation does it bear to the other seams? These questions being unsettled, it is not included *by name* in the GENERAL SECTION of this field, though it may be included *in fact*.

That *section* was constructed by *measuring across all the known out-crops of seams*, on the longest slope of the field, from southeast to northwest. If it is *not included* in that *section*, then its southeastern outcrop has not yet been discovered, and it must be in one of those wide spaces of measures which have hitherto seemed barren of coal. If it *is included*, then the character and appearance of the seam, and the quality of its coal, are materially different at its southeastern and northwestern out-crops. One or the other of these propositions is apparently true.

Of the first proposition, it may be said that it seems improbable that in the many streams descending from the top of Blount Mountain toward the river, a coal seam of the size of this one should not have been cut and exposed, if it existed in that space. And yet coal seams undiscovered may exist, as has been heretofore suggested, in that wide space that exists between Nos. 3 and 4, and also between Nos. 4 and 5 of the General Section.

That the Cowden Seam could not crop out between seams 3 and 4 may be considered demonstrated by its greaten distance than No. 4, above the second conglomerate. Seam No. 4 is about 300 feet above that conglomerate, while this seam is over 600 feet above that rock, as shown by the ex-

posed strata, beside the unknown amount of fault or upward sliding of the vertical rocks, between it and the conglomerate, as exposed in Straight Mountain. If no fault or upward thrust of the strata existed here the measurements would make the Cowden approximately coincide with the *Sand Creek* No. 1, No. 5 of the *General Section*, and the coals of these seams bear a close resemblance to each other. But the seams do not correspond in thickness, nor in the general character of their surroundings, so far as these could be seen on Sand Creek.

We must moreover consider the probable amount of upward thrust of the vertical rocks of Straight Mountain, which certainly cannot be less than the whole height of the mountain—from 300 to 400 feet—or at the lowest estimate, than the difference between the height of the top of the mountain and the general level of the adjacent coal measures. This would give an apparent depression, by so much, to the measures, as compared to the Straight Mountain rocks, hence they appear in this section *below* their normal place in the field. Taking this fact in connection with the measurements made, it becomes evident that the southeastern outcrop of this seam must be looked for higher up in measures than the upper Sand Creek Seam, and that its probable position southeast of the Cowden opening will be at, or near, the Blackburn Fork of the Little Warrior.

This portion of the field contains many coal seams, and of these Nos. 7 to 14 inclusive of the *General Section* have been cut by that little river, yet none of these carry similar coal, or have the appearance of the Cowden Seam. And there seems to be none there yet undiscovered.

Apparently the solution of the difficulty must be found in the other proposition, that some one of the seams already known has changed in character and quality of its coal, between its southeastern and northwestern outcrops. Which one is it? The answer can only be given hypothetically. The seam that from its position and general make-up would appear the most probable one, is the *Big Holt Seam* No. 7 of the *General Section*.

The Holt Seam carries about 4 feet of coal and nearly 2 feet of black band, but with an aggregate of over 5 feet of foreign matter. This foreign matter, clay, slate and rock, were probably *local inflows* of sediment during its formation, and hence not co-extensive with the seam. It is from this cause that partings in coal seams are produced, and they are for the same reason subject to great and frequent variations in thickness, often terminating altogether.

This *Holt* or *Big Seam* is probably the equivalent or counterpart of the "MAMMOTH SEAM" of the *Cahaba Coal Field*, which shows unusual variations in its splits and partings. Both occupy about the same position in the coal measures, both are about the same size, over 12 feet from roof to under clay, both have rocky parting near the middle. The Mammoth Seam splits into two seams toward the south, may not this also split toward the northwest? Or may not the partings diminish in that direction and all but one disappear as it is in the Cowden Seam? These querries can only be answered satisfactorily by future extensive explorations and practical mining operations.

A coal mine is now being opened on this seam in S. 4, T. 14, R. 1 E., near the bank of the Blackburn Fork, about one-fourth of a mile above the railroad bridge, which, in its progress, may throw additional light on the relations of this very interesting seam of coal. At this opening its position is about 15 feet above the bed of the river, with a dip of 3 deg. to the southeast; this dip in one-fourth of a mile will put it below the bed of the river which here flows northwest with a fall of 10 to 15 feet to the mile. The tunnelling of this seam for any considerable distance will afford data for calculating its range, dip and southeastern outcrop.

The seam known in the Cahaba Coal Field as the *Brock Seam*, lying just above the first or *Lower Conglomerate*, has not been opened or cut anywhere in this coal field, yet its existence is plainly indicated at many places by fossil coal plant impressions in the rocks at this horizon. And it was seen, and had been dug into, yet farther to the east, near

the top of Chandler's Mountain, lying above and close to the Lower Conglomerate or Millstone Grit rock. Its thickness here was less than one foot, and it is probably a thin seam all over this field. From the fact that it was not cut or opened, it was not embraced in the General Section and is only referred to now to show the persistency of the seam, and as further evidence of the close relation in structure which obtains in different parts of the Alabama Coal Fields.

The quantity of available coal in this field is another of the unsettled questions. It has been clearly shown in the *Section on Details* and by the *General Section* of the field, that there are *eleven* (11), possibly twelve (12), coal seams in this field that are over *three* (3) *feet thick.* Ample thickness for advantageous mining. The uncertainty as to whether there are 11 or 12 of these arises from the uncertainty in the identification of the southeastern outcrops of the Waide and Cowden seams. Now it would have been an easy matter to estimate approximately the area of each of these coal seams, and to calculate and aggregate their solid contents. Yet all this would have served no practical purpose, and would have been wholly hypothetical.

It would have been based on the supposition that these seams had been cut and measured where they were of average thickness, and that they all maintained that thickness all over their respective areas. This would be highly improbable. No reliance could be placed even on the approximate correctness of calculations based on such uncertain data. They might greatly exceed or fall far below the actual amount. It is sufficiently shown in this report that there is in this field ample coal for *all mining purposes* and *for all coming time.*

Much of this coal was discovered and exposed by the Alabama Geological Survey, especially in the years 1891-92. It was the general expression of the citizens of that section of the country "that more coal had been developed in one season by the Geological Survey than had been done by all

preceding prospectors." For the first time the coal seams were traced out and their relations shown.

Now, with the limited means and time of the survey devoted to this work, it is not probable that a full development of any one of the coal seams was obtained. Work had to be stopped on every opening before the full thickness or best quality of the coal had been reached. Only in one or two openings was any penetration made beneath the cap rock, and in every instance the coal seam was sensibly thickening when the work was stopped. Hence any estimate based on the measurements of seams thus obtained would necessarily be too low. Nothing but practical mining on each one of its important coal seams will disclose the full value and importance of this coal field.

It is shown that the productive measures at the thickest part of this field have a volume of over 3,400 feet, and that the sub-conglomerate measures have a thickness of at least 800 feet, making the whole thickness of this coal formation over 4,200. It must, however, be understood that this immense thickness of coal measures is to be found only adjacent to the Straight Mountain.

This part of the coal field is an unsymmetrical synclinal basin with its axis close to its northwestern edge, hence the deepest part of the measures lie adjacent to the mountain above named, and they thin out gradually towards the southeast, or towards the top of Blount Mountain overlooking the great Coosa Valley.

Only the great industrial developments of the future will fully expose this important coal field.

SUMMARY OF CHEMICAL ANALYSES.

By Dr. J. M. Pickel, University of Alabama.

COALS.

Number.	1	2	3	4	5
Moisture	1.49	1.27	1.46	1.17	1.18
Volatile combustible matter	32.38	36.49	32.11	34.90	32.35
Fixed carbon	61.46	56.19	64.97	59.52	64.18
Ash	4.67	6.05	1.46	4 41	2.29
	100	100	100	100	100
Coke	66.13	62.24	66.43	63.93	66.47
Sulphur	1.79	3.87	3.87	2.20	0.92

No. 1. Peacock Seam.
No. 2. Haynes Seam.
No. 3. Armstrong Seam.
No. 4. Woodward Seam.
No. 5. Baine Seam.

[THE END.]

INDEX.

ERRATA.

On page 21, last line, for "*Bucks' Pocket*" read "*The Dungeon.*"
Page 28, eighth line from bottom, for Southeast read Southwest.

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